

**Date:** 21 April 2010

**Job no:** 60541-CL

## **CIVIL SPECIFICATION - HENDERSON INTERMEDIATE**



**WOODS**

Engineers. Surveyors. Planners.

[WWW.WOODS.CO.NZ](http://WWW.WOODS.CO.NZ)

***DOCUMENT CONTROL RECORD***

**Client** WAITEMATA DISTRICT HEALTH BOARD

**Project** PROPOSED SIX CHAIR DENTAL FACILITY –  
HENDERSON INTERMEDIATE SCHOOL, WAITAKERE

**Document** CIVIL SPECIFICATION


***ISSUE AND REVISION RECORD***

**Date of Issue** 21 April 2010

**Originator**

  
Brian Flood

**Checked/Approved**

  
Daniel Williams

**Office of Origin** Albany

**Telephone** (09) 571 2470

**Facsimile** (09) 448 2788

**Email** brian.flood@woods.co.nz

*Civil Specification-Henderson.doc*

---

**Engineers. Surveyors. Planners.**

BLDG 3, LEVEL 4, 666 GREAT SOUTH ROAD, AUCKLAND, NEW ZEALAND. PO BOX 6752, WELLESLEY ST, AUCKLAND 1141, NEW ZEALAND.  
PHONE +64 9 571 2470 FAX +64 9 571 3405 WWW.WOODS.CO.NZ



## SECTION 200 SITE CLEARANCES

---

### TABLE OF CONTENTS

<b>1</b>	<b>GENERAL.....</b>	<b>2</b>
	<b>Documents.....</b>	<b>2</b>
1.1	DOCUMENTS REFERRED TO .....	2
	<b>Requirements .....</b>	<b>2</b>
1.2	ASBESTOS.....	2
<b>2</b>	<b>PRODUCTS.....</b>	<b>2</b>
	<b>Materials.....</b>	<b>2</b>
2.1	ELEMENTS FOR SALVAGE .....	2
2.2	ELEMENTS FOR RE-USE .....	2
2.3	REMAINING ELEMENTS.....	2
2.4	DEMOLITION RUBBLE FOR RE-USE.....	3
2.5	MATERIAL AND ELEMENTS FOR DISPOSAL.....	3
<b>3</b>	<b>EXECUTION.....</b>	<b>3</b>
	<b>Application.....</b>	<b>3</b>
3.1	CLEARING .....	3
3.2	UNDERGROUND SERVICES.....	3
3.3	DISPOSAL .....	3
3.4	MEASUREMENT AND PAYMENT .....	4



## SECTION 200 SITE CLEARANCES

---

### 1 GENERAL

The work specified in this section covers the clearing and disposal of vegetation and other unwanted material from within the area of the work as defined in the drawings and site specific specifications.

The Contractor shall supply all plant, materials, labour and supervision for the clearing and stripping of all such materials as is required for the proper execution of the work.

#### Documents

##### 1.1 DOCUMENTS REFERRED TO

Documents referred to in this section are:

OSH Guidelines for the management and removal of asbestos  
Health and Safety in Employment Act 1992

#### Requirements

##### 1.2 ASBESTOS

Comply with the Health and Safety in Employment Act in general and the OSH publication: Guidelines for the management and removal of asbestos, section 2: Safe removal of asbestos

##### 1.3 PRECOMMENCEMENT MEETING

A Pre-commencement meeting on site will be required prior to commencing clearing works to clearly define areas to be excluded from construction operations. The protected areas will be isolated with high visibility demarcation tape or a protective fence strong and appropriate to the degree of construction activity taking place on the site.

### 2 PRODUCTS

#### Materials

##### 2.1 ELEMENTS FOR SALVAGE

Carefully dismantle, remove and store on site where directed. Protect from damage and weather.

##### 2.2 ELEMENTS FOR RE-USE

Carefully dismantle, remove and store on site where directed. Protect from damage and weather until required.

##### 2.3 REMAINING ELEMENTS

Store all elements not scheduled for salvage or re-use on site until convenient for removal.

#### **2.4 DEMOLITION RUBBLE FOR RE-USE**

Do not contaminate with other materials and stockpile separately on site where directed and until required.

#### **2.5 MATERIAL AND ELEMENTS FOR DISPOSAL**

Remove demolished material and elements continually from the site through the period of the demolition.

### **3 EXECUTION**

#### **Application**

##### **3.1 CLEARING**

The area of the work shall be cleared of all obstructions except those specifically required to remain. Clearing shall include complete removal from the site of buildings, all growth and surface debris, including trees, logs, scrub, grass, tree roots and other vegetation, paving materials, fences, garbage and surface boulders or other materials not required in the finished contract.

All trees within the limits of the earthworks shall be felled unless otherwise specified. Trees and other vegetation beyond the limits of the earthworks shall be disturbed only when directed or approved by the Engineer. Any trees specifically designated by the Engineer shall be protected from damage by the Contractor's operations by clearly defining an appropriate protective area around them.

##### **3.2 UNDERGROUND SERVICES**

Where underground structures, manholes, wells, and similar items are discovered, their presence shall be reported immediately to the Engineer. They shall not be further disturbed until the Engineer has given instructions for their disposal.

The cavities or depressions resulting from the removal of such underground structures shall be filled in with material similar to that of the surrounding ground and compacted to a density equal to that of the surrounding ground unless the Engineer instructs otherwise.

##### **3.3 DISPOSAL**

Unless otherwise specified, all material cleared shall become the property of the contractor, and shall be removed from the site and disposed of in a safe and legal manner and so as not to inconvenience the owners of adjoining property. The Contractors shall pay any tip fees required.

Only where approved by the Territorial Authority and the Fire Service Authority, disposal of cleared material may be by way of burning. The Contractor shall obtain and comply with the necessary permits, shall take precautions to prevent fire from spreading and shall have available ready for use suitable equipment and supplies for fighting fires. Fires shall be completely extinguished at night time unless full time attendance has been arranged.

### 3.4 MEASUREMENT AND PAYMENT

Where provided in the Schedule, measurement for payment of clearing shall be by plan area of ground surface cleared in accordance with the contract. Additional payment will be made for individual trees felled or structures demolished and disposed of if such items are shown in the Schedule.

Payment at the scheduled rates or amounts for clearing and stripping shall include for all costs associated with this work. Where separate items for clearing and stripping are not shown in the schedule, payment shall be included in the rates or amounts scheduled for earthworks.

## SECTION 300 EROSION AND SEDIMENT CONTROL

---

### TABLE OF CONTENTS

<b>1</b>	<b>GENERAL</b>	<b>2</b>
	<b>Documents</b>	<b>2</b>
1.1	REFERENCED DOCUMENTS	2
	<b>Requirements</b>	<b>2</b>
1.2	PRE-WORKS REQUIREMENTS	2
1.3	CHANGES TO MEASURES DURING CONSTRUCTION	2
1.4	FLOCCULATION MANAGEMENT PLAN	Error! Bookmark not defined.
1.5	SITE REPRESENTATIVE	2
<b>2</b>	<b>EXECUTION</b>	<b>3</b>
	<b>Conditions</b>	<b>3</b>
2.1	CERTIFICATION	3
2.2	CONTROL IS CONTRACTOR'S RESPONSIBILITY	3
2.3	COMPLIANCE WITH CONDITIONS OF CONSENT	4
2.4	PROTECTION OF THE PUBLIC	Error! Bookmark not defined.
	<b>Application</b>	<b>4</b>
2.5	PROPOSALS	4
2.6	LOCATION	Error! Bookmark not defined.
2.7	MINIMUM STANDARDS AND SIZE	4
2.8	OPERATION OF SEDIMENT RETENTION POND	Error! Bookmark not defined.
2.9	DECANT STRUCTURES	4
2.10	CUT OFF DRAINS	4
2.11	DIVERSION OF CLEANWATER	4
2.12	SILT FENCES	4
2.13	SEDIMENT AND DUST CONTROL PENALTIES	5
	<b>Finishing</b>	<b>5</b>
2.14	STABILISATION	5



## SECTION 300 EROSION AND SEDIMENT CONTROL

---

### 1 GENERAL

The work specified in this section consists of the construction, maintenance and later removal of all erosion and sediment control measures required during the works as shown on the drawings and in all the consents relating to the site appended to these documents.

The contractor shall supply all plant, materials, labour and supervision necessary to complete the work in accordance with this specification.

The Contractor shall pay particular attention to minimising silt and/or pollution of neighbouring properties, reserves and streams due to the construction operations.

#### Documents

##### 1.1 REFERENCED DOCUMENTS

The following documents, including revisions, replacements and amendments up to the date of closing of tenders shall be read with and form part of this Specification unless specified otherwise:

- ARC TP90:1990      Auckland Regional Council Technical Publication # 90 – Erosion and Sediment Control, Guidelines for Land Disturbing Activities

Erosion and sediment control measures shall be constructed and maintained in accordance with TP90 and any amendments, except where a higher standard is detailed in the documents, in which case this higher standard shall apply.

The Auckland Regional Council Technical Publication 90 referred to above is available for perusal at the office of the Engineer.

#### Requirements

##### 1.2 PRE-WORKS REQUIREMENTS

The contractor shall ensure that all personnel working on the site shall be made aware of and have access to all consents relating to erosion and sediment control of the site and the associated erosion and sediment plan and methodology.

##### 1.3 CHANGES TO MEASURES DURING CONSTRUCTION

Any amendments to the Erosion and Sediment Control methodology to assist construction shall be forwarded to the Engineer for approval at least five days prior to commencing specific works.

##### 1.4 SITE REPRESENTATIVE

The Contractor shall nominate an appropriately qualified and experienced site representative to be responsible for earthworks management.

This person shall be responsible for the control of erosion and sediment in the course of construction on the site as outlined in the consent conditions and shall also have the authority and ability to immediately implement any repairs.

The contractor shall inform the Engineer of the representative's name and how they can be contacted.

## **2 EXECUTION**

### **Conditions**

#### **2.1 CERTIFICATION**

Prior to topsoil stripping and bulk earthworks commencing, the contractor shall submit to the engineer a certificate signed by an appropriately qualified and experienced surveyor or engineer to certify the erosion and sediment controls have been constructed in accordance with the erosion and sediment control plan. Certified controls shall include decanting earth bunds, silt fences and diversion channels/bunds. The certification for these subsequent measures shall be supplied immediately upon completion of construction of those measures.

Information supplied in hardcopy form, shall include:

- a) Contributing catchment area.
- b) Retention volume of structure (dead storage and live storage measured to the top of the primary spillway).
- c) Shape of structure (dimensions of structure).
- d) Position of inlets/outlets, and
- e) Stabilisation of the structure.
- f) Finished contours of, decanting earth bunds, diversion channels/bunds.

#### **2.2 CONTROL IS CONTRACTOR'S RESPONSIBILITY**

The control of the work in such a way as to avoid damage of any kind or the contravention of any of the Conditions of the Consent is the responsibility of the Contractor. He shall during periods of rain carry out sufficient inspections of all drains and sediment retention structures and do such works as may be necessary to ensure their proper functioning. These inspections shall be carried out as required at all times of night and day. The fact that this Contract requires certain measures to be taken to reduce the risk of damage in no way reduces the Contractor's responsibility. The Contractor will be expected to extend and change the protective measures as the work progresses. The Contractor shall keep a high standard of maintenance on all erosion and sediment control devices installed. If the measures are not taken to prevent damage being done to private and public properties and utilities, the Contractor shall at his own expense clean up and repair all damage including the clearing of existing public piped drains that may have become blocked and or the removal of debris and sediment from streams, lakes or harbours. Should the Contractor fail to comply with the Conditions of the Consent he will be responsible for the payment of any fines or penalties or

any other measures which may be imposed on either the Principal or the Contractor by the Council.

Should the Contractor fail to take precautions satisfactory to the Engineer, the Engineer may make other arrangements on behalf of the Principal for doing so and the Principal may charge the cost, including administrative costs, to the Contractor.

### 2.3 COMPLIANCE WITH CONDITIONS OF CONSENT

The Contractor shall take all such measures as are necessary to comply with the relevant conditions of all Consents issued to the Principal.

## Application

### 2.4 PROPOSALS

The Contractor shall construct the erosion and sediment controls as indicated on the drawings approved by Council and in accordance with Auckland Regional Council Technical Publication 90.

### 2.5 MINIMUM STANDARDS AND SIZE

Unless otherwise approved by the Engineer sediment retention structures shall be in accordance with Auckland Regional Council Technical Publication 90.

### 2.6 DECANT STRUCTURES

The contractor shall ensure decanting earth bunds are sized to provide 3m<sup>3</sup> of storage for every 100m<sup>2</sup> of contributing catchment. The contractor shall ensure decanting earth bunds are inspected regularly and accumulated sediment is removed as necessary to ensure their effective functioning.

### 2.7 CUT OFF DRAINS

The Contractor shall allow in his tender for constructing and maintaining adequate lengths of temporary cut off drains in addition to any permanent drainage channels which may be shown on the drawings. These cut off drains shall be constructed as necessary or as may be instructed by the Engineer along the toe of the batters, uphill of private property boundaries etc and are to divert surface and other water into the erosion and sediment control devices.

### 2.8 DIVERSION OF CLEANWATER

The Contractor is to divert clean water from areas outside the earthworks areas clear of the working area wherever possible. This may be by means of a cut off drain around the outside of the works, or a suitably sized novacoil drain laid in the flow of any gullies.

Sediment retention ponds shall not be sited in the alignment of major stream patterns where alternative arrangements are possible and practicable.

### 2.9 SILT FENCES

The Contractor shall erect silt fences along the contour as shown on the approved drawings within the contract area or as instructed by the Engineer to

prevent erosion. These silt fences shall consist of and/or either of the following types:

- Silt Fence Height shall be a minimum of 600mm above ground level and consist of tensioned wire along the top supported by posts/warratah embedded a minimum of 400mm into the ground with geotextile filter fabric suitably attached to the wire. It is important to dig the bottom of the fabric at least 200mm into the ground and compact firmly.
- Super Silt Fence Height shall be a minimum of 800mm above ground level and consist of tensioned galvanised wire at 400mm and again at 800mm above ground level supported by posts/warratahs embedded a minimum of 1.0metre into the ground with two layers of geotextile filter fabric suitably attached to a chain link fence. It is important to dig the bottom of the fabric at least 200mm into the ground and compact firmly.

Inspect at least once a week and after each rainfall event. Remove accumulated sediment when it reaches 50% of the fabric height.

## 2.10 SEDIMENT AND DUST CONTROL PENALTIES

Should the consenting authority serve an abatement notice on the consent holder, requiring works to cease due to non-conforming activities, the contractor shall immediately cease all other works and remedy the fault.

Any time delays accruing from interrupting the works due to any notice so served will not be allowed as grounds for a time extension. Resumption of scheduled construction works shall not be permitted until written authority is granted by the body issuing the abatement notice.

If any consenting authority serves any infringement notices on the consent holder, by reason of the works not meeting the approved standards, all costs associated with this will be deducted from the contract value.

## Finishing

### 2.11 STABILISATION

The site shall be stabilised against erosion as soon as practicable and in a progressive manner as earthworks are finished over various areas of the site.

When approval is obtained from the Engineer for the removal of the erosion and sediment controls, the Contractor will be instructed to fill sediment retention ponds, drains etc and to reinstate these areas. If the Engineer's approval is not obtained the Contractor shall leave the erosion and sediment control measures in good working order for others to operate after the completion of the Contract and the payment for its removal will not be paid to the Contractor.

## SECTION 400 EARTHWORKS

### TABLE OF CONTENTS

<b>1 GENERAL</b>	<b>3</b>
<b>Related Work</b>	<b>3</b>
1.1 RELATED SECTIONS	3
<b>Documents</b>	<b>3</b>
1.2 REFERENCED DOCUMENTS	3
<b>Definitions</b>	<b>3</b>
1.3 DEFINITION OF TERMS	3
<b>Performance</b>	<b>4</b>
<b>2 PRODUCTS</b>	<b>4</b>
<b>Materials</b>	<b>4</b>
2.1 CLASSIFICATION OF MATERIAL	4
<b>3 EXECUTION</b>	<b>6</b>
<b>Conditions</b>	<b>6</b>
3.1 ORIGINAL GROUND LEVELS AND SETTING OUT	6
3.2 PROTECTION OF NEIGHBOURING AND ADJACENT PROPERTY AND RESTRICTIONS ON HOURS OF WORKING	6
3.3 TREES AND VEGETATION	7
3.4 SURFACE DRAINAGE	7
3.5 TEMPORARY FENCING	7
3.6 SALVAGING AGGREGATE FROM EXISTING PAVEMENTS	8
<b>Application</b>	<b>8</b>
3.7 REMOVAL OF TOPSOIL	8
<b>Application – Excavation</b>	<b>8</b>
3.8 MANAGEMENT	8
3.9 UNDERCUTTING	9
3.10 CONSTRUCTION BATTERS	9
3.11 DUMP AREAS	9
3.12 BORROW AREAS	9
3.13 BENCHING	9
3.14 SIDE DRAINS	10
<b>Application – Filling</b>	<b>10</b>
3.15 GENERAL	10
3.16 SUBGRADE FILLING	10
3.17 COMPACTION AND SIZE CONTROL METHODS	11
3.18 LAYER THICKNESS	11
3.19 COMPACTION	11
<b>Application – Subgrade surface finishing</b>	<b>11</b>
3.20 TRIMMING AND ROLLING	11
3.21 SURFACE FINISHING TOLERANCES	12
3.22 SUBGRADE UNIFORMITY TESTING	12
3.23 SURFACE WATER CHANNELS	12
<b>Application – Slips</b>	<b>12</b>
3.24 SLIPS	12
<b>Application – Intersecting roads and private accessways</b>	<b>13</b>
3.25 INTERSECTING ROADS AND PRIVATE ACCESSWAYS	13
<b>Application – Shaping and Topsoiling</b>	<b>13</b>
3.26 SLOPES 2:1 AND FLATTER	13
3.27 SLOPES STEEPER THAN 2:1	13
<b>Application – Grassing and Batter Protection</b>	<b>13</b>
3.28 GENERAL	13
3.29 SLOPES 2:1 AND FLATTER	13

3.30 SLOPES STEEPER THAN 2:1 .....14

**Application – Traffic Control..... 14**

3.31 TRAFFIC CONTROL .....14

**Application – Maintenance of Works..... 14**

3.32 MAINTENANCE OF WORKS .....14

**Application – Measurement and Payment .....Error! Bookmark not defined.**

3.33 MEASUREMENT AND PAYMENT .....Error! Bookmark not defined.

## SECTION 400 EARTHWORKS

---

### 1 GENERAL

This specification covers the construction of the earthworks including: the clearing and removal of all obstacles within the limits of the earthworks; the excavation of all cuts, including excavation below the final subgrade surface; the excavation of borrow areas, benches and surface drainage facilities; the carting of the excavated material to fill or waste; and construction of the fills and subgrade; shaping, trimming, grassing and maintaining of the works.

#### Related Work

##### 1.1 RELATED SECTIONS

Refer to Section 200 for Site Clearing requirements

Refer to Section 300 for Erosion & Sediment Control

#### Documents

##### 1.2 REFERENCED DOCUMENTS

Documents referred to in this section are:

NZS4402 – Methods of Testing Soil for Soil Engineering Purposes.

NZS 4431 – Code of Practice for Earth Fill for Residential Development

It is the responsibility of the contractor to be familiar with the materials and expert in the techniques quoted in these publications.

Note: Documents listed above and cited in the clauses that follow are part of this specification. Where there are differences between this specification and the relevant Territorial Authority requirements, the Territorial Authority requirements shall take precedence.

#### Definitions

##### 1.3 DEFINITION OF TERMS

- a. "Bulk Fill" is all that material obtained from cutting or another place, placed in the fill, to raise the level of the land, from the ground surface after clearing and removing of top soil.
- b. "Borrow" is excavation from outside the construction batter limits shown on the drawings.
- c. "Cut" is excavation within the construction batter limits shown on the drawings and above the designed profile and/or final subgrade surface.
- d. "Granular Fill Material" is material which has been placed in the fill and which contains particle size no smaller than sand.



- e. "Overbreak" is the excavated material removed by the Contractor's operations from outside the construction cut batter limits shown on the drawings, but not authorised as borrow.
- f. "Rock" is any igneous, sedimentary, or metamorphic stone which is solidly bonded or cemented together and which occurs in masses, ledges, seams or layers.
- g. "Side Drain" is an open drainage excavation often at the toe of a fill batter. TNZ F/1: 1997
- h. "Slip" is material dislodged by the forces of nature from outside the cut batter limits or from the fill slope shown on the drawings.
- i. "Subgrade" is defined as that layer of material in the top 1.0 m of the construction measured down from the underside of the subbase course. It may be fill or insitu material.
- j. "Surface Water Channel" is a water channel formed at the subgrade surface at the edge of the road.
- k. "Undercut" is excavation from just below the designed profile and/or subgrade surface. This may be an extension of the depth of cut in a cut area.
- l. "Topsoil" is that layer of material immediately below the ground surface, which includes vegetation, turf and humus or other organic matter.

## **Performance**

### **1.4 GROUND CONDITIONS**

The contractor shall satisfy itself as to the nature of the ground to be excavated before submitting a tender. Where subsurface information obtained by the engineer is made available, it is done so without guarantee as to its accuracy or completeness. Tenderers shall make their own deductions as to the information provided.

### **1.5 OPERATION OF PLANT**

The contractor shall be responsible for the determination of suitable types of plant to carry out the excavation operations in accordance with the contract.

## **2 PRODUCTS**

### **Materials**

#### **2.1 CLASSIFICATION OF MATERIAL**

Material to be excavated shall be classified as type A, R1, R2, W, U as defined below.





Whenever the Contractor wishes material to be classified as other than type A, the Contractor shall notify the Engineer in writing as soon as possible seeking a decision. This decision shall be progressed promptly.

a. Type A Material

Type A material is all material which does not fall within categories R1, R2, W, or U.

b. Type R1 Material

This is rock which cannot be productively ripped unless equipment is used which is more powerful than a crawler tractor having net engine (or flywheel) power in the range 100–115 kW and fitted with a twin shanked hydraulic ripper. If a tractor meeting the above specification is not readily available then, a 30 tonne hydraulic excavator using a bucket may be used to determine R1 materials. Alternatively, a smaller excavator with a single tyne ripper may be used providing its performance has been compared with a crawler tractor in similar materials.

c. Type R2 Material

This is rock which cannot be productively ripped unless equipment is used which is more powerful than a crawler tractor having net engine (or flywheel) power in the range 270–310 kW and fitted with a single shanked hydraulic ripper. If a tractor meeting the above specification is not readily available then, a 30 tonne hydraulic excavator with a single ripper on the boom may be used to determine R2 materials, providing the performance of the hydraulic excavator has been compared with a crawler tractor in similar materials.

d. Ripping Trials

Where agreement cannot otherwise be reached on classification of type R1 and R2 materials. Productivity trials shall be carried out using one of the categories of plant required to determine the classification as described above, under the supervision of the Engineer. The Engineer shall determine the material type from the trial.

Where the appropriate plant is not available on site, the Contractor will be reimbursed for the cost of transporting it.

e. Type W Material

This is material which is too wet for immediate use but is suitable for use in construction fill after drying. This material may be cut to waste if the Engineer considers the drying operation to be uneconomic.

f. Type U Material

This is material which should not be used in construction fill unless specifically approved by the engineer otherwise, due to one or more of its following inherent properties making it unsuitable:

- grain size;
- moisture sensitivity; or
- organic content.



### 3 EXECUTION

#### Conditions

##### 3.1 ORIGINAL GROUND LEVELS AND SETTING OUT

The original levels and contours shown on the earthworks drawings have been based on either aerial photographic surveys, LIDAR or by conventional modern survey methods. Before earthworks are started the Contractor and the Engineer may jointly take such check or take spot levels as they consider necessary to confirm the accuracy of these drawings and levels.

Should any inaccuracies be found (due to vegetation cover or any other reason) then the area so affected shall be re-surveyed jointly by the Contractor and the Engineer and the new levels so obtained substituted for the original levels.

Should the Contractor be either unwilling or unable to carry out this check of ground levels then the original levels or those amended by the Engineer as a result of his check of ground levels will be taken as final and used for the calculation of earthworks and other quantities.

Basic setting out control marks will be provided by the Engineer as indicated on the Contract drawings. The Contractor will be responsible for preserving these marks or offsetting and replacing them as necessary. The Contractor is to set out the earthworks from the given marks, shown on the setting out plan, and is responsible for ensuring that the earthworks are completed accurately to line and level. The Contractor is required to check by field measurement and calculation that the pegged position of the toe of the fill batters and the top of the cut batters are such that the cut batters will be in the position and to the level shown on the drawings. Co-ordinate values will be given for all centreline peg positions and it shall be the Contractor's responsibility to peg these points as he requires them.

##### 3.2 PROTECTION OF NEIGHBOURING AND ADJACENT PROPERTY AND RESTRICTIONS ON HOURS OF WORKING

The Principal places the greatest importance on the protection of neighbouring and adjacent property (whether public or private) and accordingly throughout the period of the Contract the Contractor shall take all necessary care to prevent damage to neighbouring property and inconvenience to the owners and occupiers of such property. Throughout the period of the Contract the Contractor shall indemnify and hold harmless the Principal against any claim or other proceeding from the owners or occupiers of neighbouring properties. No plant, buildings, rocks, earth, water slurry, vegetation or other matter shall be placed or allowed to roll, slide, wash or blow across adjacent boundaries.

Where in the opinion of the Engineer, there is the possibility of such action occurring, the Contractor shall erect barriers, construct silt traps, dig drains, lay pipes and take such other action as may be necessary to protect or prevent inconvenience to the neighbouring property or properties. Should the Contractor cause, or be likely to cause, a noise or nuisance he shall adjust his method or timing of work, ensure that efficient silencers are fitted to his machines and take such other measures as may be necessary to minimize the nuisance.



The Engineer reserves the right to stop the Contractor starting earthworks in any area until approved protective measures have been commissioned and to stop earthworks once started if the protective measures prove in any way to be inadequate. The cost of such protective works shall be borne by the Contractor and he should allow for this when tendering.

The Contractor will be deemed to have determined during the Tender period what restrictions, if any, the Territorial Authority are likely to place on hours of working and to have fixed his rates accordingly.

The provision of such barriers, silt traps, drains, etc shall be to the approval of the Engineer. However, no approval by the Engineer shall relieve the Contractor of any of his obligations to protect adjoining property or to prevent causing nuisance.

### 3.3 TREES AND VEGETATION

The Contractor is to undertake the work with nil damage to the remaining vegetation unless specifically approved by the engineer. The Contractor is to confine the operation of machines only to the areas of cut and fill unless otherwise directed by the Engineer. Haul roads into and out of fill and cut areas will not be permitted in areas that cannot be reinstated or are likely to remain as a permanent scar. The Contractor is to instruct all his workmen of the importance of retaining as much vegetation as possible.

Where in the opinion of the engineer vegetation has been destroyed when it need not have been, he shall deduct from monies due to the Contractor sufficient to pay for the cost of replanting and reinstating the area as he sees fit.

### 3.4 SURFACE DRAINAGE

Surface drainage shall be constructed so as to maintain the natural water drainage facilities and limit the introduction of water into the earthworks.

Adequate provision shall be made for the control of surface water within the construction site as required by any resource consents.

Additional temporary surface drainage works shall be carried out during construction as required to safeguard the integrity of the works.

The earthworks shall be carried out in such a manner that their surfaces have at all times a sufficient fall to shed water and prevent ponding.

The surfaces of all earthwork areas shall be kept adequately drained at all times. In particular, the formation surface within 3.0m of fill batters shall be kept graded away from the top of the batter and surface water shall be led to suitable discharge positions by means of scalloped drains. Where required by the Engineer, intercepting drains shall be dug at the toe of batters and adjacent to property boundaries to protect adjoining owners from possible damage by flood, silt or erosion. The Contractor shall maintain all drains in a satisfactory condition and if required shall erect silt traps, warning notices or take other protective measures to eliminate any possibility of damage.

### 3.5 TEMPORARY FENCING

Temporary fencing shall be erected and maintained until permanent fencing is constructed or until the end of the contract at locations indicated in the

documents and wherever existing fencing is dismantled unless the Engineer approves otherwise in writing.

The temporary fencing shall have a stock holding capacity similar to that of adjacent existing fences unless detailed otherwise in the contract documents.

### 3.6 SALVAGING AGGREGATE FROM EXISTING PAVEMENTS

When required by the contract documents, aggregate from the existing pavement, which is no longer required, shall be salvaged for reuse.

The limits of the area to be salvaged will be defined in the contract documents.

The area shall be scarified and windrowed free of soil, clay, or other contaminating material. The aggregate shall then be uplifted and carted to stockpile and/or spread as specified.

#### **Application**

### 3.7 REMOVAL OF TOPSOIL

Topsoil shall be removed within the limits of the earthworks. Care shall be taken during the removal to avoid contamination of the topsoil.

Topsoil shall be stockpiled in areas approved by the Engineer for this purpose.

The Contractor shall control all stockpiling operations to ensure the maximum utilisation of each area.

#### **Application – Excavation**

### 3.8 MANAGEMENT

Where the material being excavated includes "cut to fill" material and "cut to waste" material, the excavation shall be carried out in such a manner as to avoid mixing of the materials.

Material that is excavated to waste below the subgrade surface shall be replaced with suitable material, either:

(a) from surplus cut elsewhere in the works, in which case the material will be paid for as cut to fill as if it had been from the same cutting as the wasted material, or as approved by the Engineer,

(b) from borrow, in which case payment will also be made as cut to fill .

The earthworks shall also be managed in such a manner that as far as is reasonably practicable the best material (material with the higher California Bearing Ratio) is reserved for the construction of the subgrade.

Double handling or extended leads exceeding 500 m of the material for this reason, shall be carried out where ordered by the Engineer and the extra work involved will be treated as a variation.



Where construction traffic uses the areas to be excavated or filled, cuts and fills shall be left 400 mm above or 400 mm below the final subgrade surface respectively, until most of the earthworks have been completed.

Excavation shall be carried out so as to limit overbreak as far as is practical.

Where specified in the contract documents material shall be excavated in such a manner as to minimise strength loss in the material.

### 3.9 UNDERCUTTING

All cuts, unless specifically excluded, shall be undercut to ensure continuity in the construction of the subgrade layers.

The depth of the undercut in materials will be specified by the Engineer when the material at the subgrade level has been exposed and evaluated.

On completion of the undercut, the surface shall be shaped, trimmed and compacted so as not to hold water. The compaction shall be as specified in Clause 3.17.

### 3.10 CONSTRUCTION BATTERS

Cut batters shall not be grader trimmed to a smooth surface but all loose rocks or other materials which appear likely to fall at a later stage shall be removed as the cut proceeds.

Fill batters shall be adequately compacted as the filling proceeds.

All batters shall be left with a texture which will help establishment of vegetation.

### 3.11 DUMP AREAS

The locations of dump areas shall be agreed by the Engineer before use.

The Contractor shall control all dumping operations to ensure the optimum utilisation of each area. The dump shall be shaped during the progress of the work to conform with the contours of the adjoining land and prevent ponding of storm water or as directed by the Engineer.

The Contractor may provide alternative dumpsites outside the works area on provision of adequate approval to use the dump site.

### 3.12 BORROW AREAS

Borrow areas shall be opened up and excavated in an orderly manner at locations agreed by the Engineer.

At completion, the borrow area shall be shaped to blend with surrounding contours or as agreed by the Engineer.

### 3.13 BENCHING

Any portion of the ground whose slope is steeper than three horizontal to one vertical shall be benched before filling is placed on it, unless otherwise directed by the Engineer.

Each bench shall be constructed to a width adequate to permit suitable construction equipment to operate on it. The base of the benches shall be sloped inwards at a slope of 12 horizontal to 1 vertical. The longitudinal profile of each bench shall be graded to ensure adequate drainage and safe discharge of water.

#### 3.14 SIDE DRAINS

Side drains shall be excavated as detailed in the contract documents with an even and true grade to outlets so that water will not stand in any part.

All outlets shall be clear of made ground or as otherwise described in the contract documents.

Material excavated from side drains shall be utilised or disposed of as appropriate to its classification.

### Application – Filling

#### 3.15 GENERAL

The Engineer shall nominate material which shall not be used in bulk filling and material which shall not be used in subgrade filling. If cuts do not provide sufficient suitable material for fills, additional material shall be obtained from nominated borrow areas.

The material used in fill shall be spread and compacted in layers of uniform quality and thickness, parallel to the camber and grade for the full width of the cross-section unless specified otherwise or approved otherwise by the Engineer.

The thickness of each layer shall be limited to ensure that the specified compaction is achieved for the full depth of each layer.

The movement of all construction vehicles and other traffic shall be evenly distributed over the full width of the filling area, so as not to damage or overstress the construction.

If at any time the Engineer considers the material too wet or dry for compaction, or finds after testing that the water content is not within the limits specified, he shall order the compaction operation to cease, and corrective measures to be undertaken on the sub-standard fill in place.

When drying is necessary it shall be carried out by discing and blading the material, until the correct water content is achieved.

If wetting becomes necessary, it shall be carried out with sprinkling equipment of a type which ensures uniform and controlled distribution of the water. After wetting, the material will be disced and bladed to ensure a uniform distribution of water throughout the material.

#### 3.16 SUBGRADE FILLING

If part width construction is approved for subgrade filling, the layers of the second part shall be placed to overlap on the completed part by benching out the completed part at the level of each successive layer.

The subgrade layer shall be constructed over adjoining cut and fill sections in one operation so as to provide continuous construction over the joining line between cut and fill.

### 3.17 COMPACTION AND SIZE CONTROL METHODS

The Contractor shall submit to the Engineer details of the proposed compaction methods and details and capacities of the compacting equipment before filling commences.

Where the Engineer requires, the Contractor shall submit details of the proposed method of controlling the maximum particle size for the subgrade.

### 3.18 LAYER THICKNESS

The maximum thickness of each layer of fill before compaction shall be in accordance with site specific compaction requirements and/or the Geotechnical Investigation Report unless field trials show, to the satisfaction of the Engineer, that the specified compaction is obtained with thicker layers.

### 3.19 COMPACTION

The standard of compaction and method of determination shall be as set out in NZS4431. Where NZS4431 is not applicable, the methods and standards of compaction shall be specified by the Geotechnical Investigation Report.

When drying is necessary, it shall be carried out to allow the full depth of the layer to dry uniformly. Drying and compaction shall be carried out under favourable weather conditions.

Wetting of material which has become too dry for use in the fill shall be carried out with sprinkling equipment of a type which ensures uniform and controlled distribution of water. After wetting, the material shall be mixed to ensure a uniform distribution of moisture throughout the layer.

Compaction shall not continue if the material shows signs of heaving or weaving excessively. In this situation, the material shall either be left to dry naturally or, where job progress would be affected by a delay, the material shall be dried to a moisture content at which heaving and weaving does not occur.

1 Standard compaction is the compaction specified in NZS 4402 Part 2P: 1981, Test 14 "Determination of the Dry Density/Water Content Relationship (NZ Standard Compaction)".

## **Application – Subgrade surface finishing**

### 3.20 TRIMMING AND ROLLING

The entire surface of the subgrade shall be made firm, uniform, and smooth by blading, grading and rolling. Rolling associated with the surface finishing shall be the same as that which would produce the compaction specified for the particular material in Clause 3.17.

The use of construction traffic on the finished subgrade shall be controlled so as not to damage the completed work.

### 3.21 SURFACE FINISHING TOLERANCES

The contractor shall observe the following tolerances for finished ground levels in his earthmoving operations:

- A Embankments shall be placed true to line, level, grade and/or cross sections as shown on the drawings. The top of the embankment shall not vary more than 0.5 metre into the flatter area at the top than the position shown on the plans. Under no circumstances shall the grade be any steeper than that shown on the drawings.
- B Section areas (flatter than 1.5 to 1) shall be excavated or filled true to line, level, grade and/or cross sections as shown on the drawings. Levels shall be to within 150mm of the contours or spot levels indicated.
- C Road areas shall be cut to 600mm behind the kerb face line to allow for easy construction of kerb and channel and the contractor shall cut the subgrade for footpath, road and berm to a tolerance of not more than 30mm below and above the required level and so that no point on the finished surface varies by more than 10mm from a 3 metre straight edge laid either parallel or at right angles to the road centre line.

### 3.22 SUBGRADE UNIFORMITY TESTING

Benkelman beam or other subgrade testing shall be carried out as described in Contract documents.

### 3.23 SURFACE WATER CHANNELS

Surface water channels shall be uniformly graded so that they will not hold water and shall be neatly and evenly trimmed to allow unimpeded flow.

All outlets shall be clear of made ground or as otherwise described in the documents.

## Application – Slips

### 3.24 SLIPS

Material from slips shall be removed and used in fills or dumped as directed by the Engineer. Slips which occur prior to completion of subgrade trimming at the location of the slip shall be considered as earthworks cut to waste or fill as appropriate.

The area affected by the slip shall be shaped, trimmed and repaired as directed by the Engineer and the extra work involved will be treated as a variation.



**Application – Intersecting roads and private accessways****3.25 INTERSECTING ROADS AND PRIVATE ACCESSWAYS**

All private roads and accessways within the limits of the contract shall be constructed, trimmed and maintained to the same standard as the Public Roads unless detailed otherwise in the contract documents.

**Application – Shaping and Topsoiling****3.26 SLOPES 2:1 AND FLATTER**

Dump areas, borrow areas, stripped land within the road reserve and any other areas nominated by the Engineer with a slope of two horizontal to one vertical or flatter, shall be trimmed to conform with the adjoining land as directed by the Engineer. The transition zone between disturbed and undisturbed land shall be treated so that the profile is continuous and compatible.

After trimming, the areas shall be covered with topsoil to a depth of 75 mm or as specified in the contract documents.

**3.27 SLOPES STEEPER THAN 2:1**

Disturbed areas steeper than 2:1 other than cut batters shall be trimmed to produce an even profile with a surface texture which will help establishment of vegetation.

**Application – Grassing and Batter Protection****3.28 GENERAL**

The Contractor shall programme the batter protection works and grassing of disturbed areas to take advantage of the Territorial optimum growth period.

Unless specified otherwise in the contract documents the Contractor shall submit to the Engineer for approval his proposed seed mixture, fertiliser type, and respective application rates prior to the commencement of the grassing. The generic characteristics of the seed mix for use within proposed grassed areas shall be such that the vegetation cover is low growing with a robust and deep rooting system, and well suited to the soil conditions and Territoriality. Reference should also be made to Territorial Authority requirements for grassing types and application rates.

**3.29 SLOPES 2:1 AND FLATTER**

The topsoil layer shall be dragged and trimmed to reduce the surface to a tilth free from clods. The top 20 mm of the topsoil layer shall be free and open in preparation for the application of the seed mixture, while the remaining portion shall be firmly compacted.

On completion of the topsoil cultivation, the total area shall be sown with the approved seed mixture and fertiliser at the approved application rates. The sowing operation shall include the broadcasting or direct drilling of the seed and fertiliser mixture, the embedding of the mixture within the surface layer of the topsoil and the final levelling and light compaction of the ground surface.

**3.30 SLOPES STEEPER THAN 2:1**

All batters and other disturbed slopes steeper than 2:1 shall be covered with an approved mulch retention seeding system incorporating the approved seed mixture and fertiliser at the approved application rates.

The mulch shall be homogeneous and of sufficient thickness and durability to hold the seed germination period and until the seeding roots have embedded themselves in the natural soil surface. From this time, the mulch matrix shall gradually disintegrate and decompose completely.

**Application – Traffic Control****3.31 TRAFFIC CONTROL**

When working on Public Roads, the Contractor shall at all times during the construction of the works take responsibility to ensure all traffic control is carried out in accordance with the NZS 4404:2004 or the relevant Territorial Authority requirements.

A road opening application will be required when undertaking construction in the road reserve. A copy of the approval shall be provided to the engineer prior to commencement of these works.

**Application – Maintenance of Works****3.32 MAINTENANCE OF WORKS**

The Contractor shall maintain the subgrade and all other parts of the earthworks construction either until they are covered with later construction or until the end of the defects liability period referred to in the Special Conditions of Contract whichever comes last.

## SECTION 500 ROAD CONSTRUCTION

### TABLE OF CONTENTS

<b>1</b>	<b>GENERAL.....</b>	<b>2</b>
	<b>Related Work.....</b>	<b>2</b>
1.1	RELATED SECTIONS .....	2
	<b>Documents.....</b>	<b>2</b>
1.2	REFERRED DOCUMENTS .....	2
<b>2</b>	<b>PRODUCTS.....</b>	<b>2</b>
	<b>Materials – supply of basecourse materials.....</b>	<b>2</b>
2.1	SUPPLY OF BASECOURSE MATERIALS.....	2
2.2	TEST SAMPLES .....	2
2.3	GRADING.....	3
	<b>Materials – supply of subbase materials .....</b>	<b>3</b>
2.4	SUPPLY OF SUBBASE MATERIALS .....	3
2.5	TEST SAMPLES .....	3
2.6	GRADING.....	3
<b>3</b>	<b>EXECUTION.....</b>	<b>3</b>
	<b>Conditions.....</b>	<b>3</b>
3.1	PROTECTION OF KERBS, CHANNELS AND SERVICES.....	3
3.2	PROTECTION OF SUBGRADE.....	3
3.3	INSPECTION BY THE ENGINEER AND LOCAL AUTHORITY .....	4
	<b>Application – pavement construction.....</b>	<b>4</b>
3.4	PAVEMENT CONSTRUCTION.....	4
3.5	SUBBASE AND BASECOURSE DEPTHS .....	4
3.6	SUBBASE UNDER KERBS AND CHANNELS .....	5
3.7	CONSTRUCTION OF SUBBASE AND BASECOURSE.....	5
3.8	DEFECTS TO BE MADE GOOD.....	6
3.9	SURFACE FINISH .....	6
	<b>Application – pavement surface .....</b>	<b>6</b>
3.10	CONSTRUCTION OF PAVEMENT SURFACE .....	6
	<b>Application – two coat chip seal.....</b>	<b>6</b>
3.11	TWO COAT CHIP SEAL .....	6
3.12	PREPARATION OF SURFACE FOR SEALING .....	7
3.13	SEALING CHIPS .....	7
3.14	APPLICATION RATES OF SEALING BINDER .....	7
3.15	REPAIR OF DAMAGE CAUSED BY RAIN .....	7
3.16	REMOVAL OF SURPLUS CHIPS.....	8
3.17	MAINTENANCE .....	8
3.18	PAYMENT .....	8
	<b>Application – asphaltic concrete.....</b>	<b>8</b>
3.19	ASPHALTIC CONCRETE .....	8
3.20	ASPHALTIC BINDER.....	8
3.21	VARIATION TO NORMAL MIX DESIGN.....	8
3.22	DEPTH AND TYPE OF MIX.....	9
3.23	MEMBRANE SEAL COAT.....	9
3.24	SWEEPINGS .....	9

## SECTION 500 ROAD CONSTRUCTION

---

### 1 GENERAL

The work described in this section of the Specification includes but is not limited to the supply, spreading, compaction and trimming of subbase and basecourse metal, and the construction of a pavement surface consisting of either asphaltic concrete including a membrane seal or a two coat chip seal as shown on the drawings.

#### Related Work

##### 1.1 RELATED SECTIONS

Refer to Section 600 for Construction of Kerb and Channel

Refer to Section 700 for Construction of Concrete Footpath, Vehicle Crossings and Accessways.

#### Documents

##### 1.2 REFERRED DOCUMENTS

This section of the Specification covers the construction of roads in residential developments and should be read in conjunction with the current edition of the relevant Transit New Zealand Specifications. Should any conflict arise or exist between this Specification and the relevant Transit New Zealand Specification then this Specification will take precedence. All Transit New Zealand Specification and other Specifications referred to are available for perusal at the Engineer's office.

Note: Documents listed above and cited in the clauses that follow are part of this Specification. Where there are differences between this Specification and the Territorial authority requirements, the Territorial authority requirements shall take precedence.

### 2 PRODUCTS

#### Materials – supply of basecourse materials

##### 2.1 SUPPLY OF BASECOURSE MATERIALS

Unless stated otherwise on the plans or in the schedule all basecourse materials shall comply with the requirements of TNZ M/4 2005

##### 2.2 TEST SAMPLES

The Engineer may require the Contractor to supply, or may take himself, representative samples of aggregate from the quarry stockpile, from trucks, from the road under construction or from the completed road. Any sample taken shall weigh approximately 30kg. Alternatively the Contractor shall supply grading curves and crush resistance tests that demonstrate that the material used complies with the TNZ M/4:2005.

### 2.3 GRADING

Unless otherwise specified by the Engineer the grading and shape of basecourse shall comply with the requirements of size and shape set out in TNZ Specification M/4:2005 for grade AP40. For minor roads with approval of the Territorial Authority a basecourse known as AP40 may be used.

### Materials – supply of subbase materials

### 2.4 SUPPLY OF SUBBASE MATERIALS

Materials for construction of sub base layers shall be well graded crushed rock, free from silt or clay lumps, organic and other non-mineral matter. The material shall be evenly graded for a maximum particle size of 65mm down to fine material. It shall contain sufficient gritty fines, including approved binder material to completely fill voids without undue excess and to give thorough compaction under rolling. All materials supplied shall be in accordance with Territorial Authority requirements.

### 2.5 TEST SAMPLES

The Contractor shall state in his tender the material he proposes to use, and shall supply a representative sample of at least 30kgs when required. Alternatively the Contractor shall supply grading curves and crush resistance tests that demonstrate that the material used complies with the TNZ/M4:2005.

### 2.6 GRADING

Grading envelopes shall be in accordance with the subbase quality requirements as set out in the relevant Territorial Authority standards.

## 3 EXECUTION

### Conditions

### 3.1 PROTECTION OF KERBS, CHANNELS AND SERVICES

The Contractor shall take care to avoid damage or marking to kerbs, channels, cesspits, manhole tops, pipes or other services above, at or below ground level during metal construction and sealing or paving operations. Any damage occurring shall be repaired to the satisfaction of the Engineer and at the Contractor's expense. If kerb and channel is damaged the Engineer may require considerable lengths of it removed and reconstructed to avoid a patched appearance and to minimize the number of joints between new and original concrete.

### 3.2 PROTECTION OF SUBGRADE

The Contractor shall take all reasonable care during the laying and compaction of the subbase and basecourse to prevent any damage, being done to the subgrade. Should any damage to the subgrade become apparent the Contractor shall cease operations immediately and inform the Engineer who will inspect the subgrade and instruct the Contractor on the course of action to be followed.

If the damage to the subgrade is found by the Engineer to be the result of the Contractor's neglect or carelessness, the cost of any remedial measures necessary shall be borne by the Contractor. This particularly applies to

damage caused by concrete trucks bringing concrete on the subbase for cast-in-situ kerb and channel. The Engineer shall certify and the Contractor shall be paid for remedial measures at scheduled rates or if there is no schedule rate at a rate to be determined by the Engineer, if the work required is not due to the Contractor's negligence.

### 3.3 INSPECTION BY THE ENGINEER AND TERRITORIAL AUTHORITY

In addition to any testing or inspection by the Engineer required by this or other sections of the Specification the Contractor is to programme his work to allow and facilitate the following inspections by the Engineer and Territorial Authority representatives and obtaining their approval to:-

- a) the prepared subgrade (including Benkelman Beam, CBR tests or Scala Penetrometer tests) before any subbase or basecourse aggregate is laid;
- b) the completed subbase and basecourse (including Benkelman Beam tests) before any membrane seal or first coat seal is applied;
- c) the completed first coat seal before the second coat seal is applied;
- d) the completed membrane seal before the asphaltic concrete is laid;
- e) the completed asphaltic concrete pavement or two coat seal (including Benkelman Beam tests).

### Application – pavement construction

#### 3.4 PAVEMENT CONSTRUCTION

The basecourse shall be constructed on the prepared surface of the subgrade or subbase in accordance with the Specification and in conformity with the lines, grades and typical cross-sections shown on the drawings.

If the drawings show only the profile of the finished road the Contractor is to make due allowance for the thickness of the pavement surface when completing the top of the basecourse. The crossfalls of the finished basecourse shall grade accurately to meet the upper edges of the concrete side channels, whether the pavement surface is to be asphaltic concrete or two coat seal. The finished and broomed surface of the basecourse shall be within 10mm of the level shown on the drawings. The finished asphaltic concrete surface shall finish 5mm above the channel, thus the finished basecourse shall finish the relative depth below the lip of the channel, for a two coat chip seal the basecourse shall be finished at channel level.

The metal beneath the kerbing shall extend 350mm behind the kerb face; the metal is to be a continuation of the subbase metal and shall not be less than 50mm thick.

#### 3.5 SUBBASE AND BASECOURSE DEPTHS

The depth of compacted subbase and basecourse shall be as shown on the drawings unless the Engineer directs that a greater or lesser depth is to be used as a result of tests carried out by the Engineer and/ or Territorial Authority on the subgrade. These tests will either establish the CBR of the subgrade or measure the subgrade deflection with a Benkelman Beam.

Payment for both subbase and basecourse shall be at a scheduled rates for solid measures calculated at the depth of subbase and basecourse either shown on the drawings or as instructed by the Engineer.

Where there are obvious local areas of weak subgrade, these shall be removed by the Contractor and the subbase metal depth increased accordingly. Payment for this work shall normally be at scheduled rates unless the cause of the weak subgrade shall be proved to be poor compaction of the clay on the part of the Contractor or bad workmanship such as letting water lie in a hollow on the subgrade. In this case all remedial work shall be at the Contractor's expense.

Whatever the depth specified it shall apply over the whole road surface between edges where kerb and channels are required. Where the road is not contained by kerb and channel the metal course shall be tapered off at a slope not steeper than 3 to 1, this batter being entirely outside the specified road width.

### 3.6 SUBBASE UNDER KERBS AND CHANNELS

Subbase shall be laid under the lines of kerb and channel before the roadway subgrade is prepared or basecourse for the carriageway proper is laid.

A strip of subgrade under the line of the kerb and channel is to be formed accurately to line and level and to the requirements of the section of the Specification appropriate to the subgrade. After inspection and approval by the Engineer subbase is to be spread and compacted along the strip of prepared subgrade to the requirements of this section of the Specification and to a minimum compacted depth of 75mm to provide a foundation for the kerb and channel accurate to the appropriate lines and levels shown on the drawings.

### 3.7 CONSTRUCTION OF SUBBASE AND BASECOURSE

The subgrade shall have been inspected and approved by the Engineer, and by the Territorial Authority if so required, before any metal is spread over the area of the carriageway. Metal shall not be laid on a wet subgrade and loaded trucks shall not be permitted to run over any prepared subgrade before metal is spread.

The subbase or basecourse material shall be placed on the prepared subgrade in layers of uniform thickness. When a compacted layer of 150mm or less is required the metal shall be placed in a single layer. When a compacted layer of more than 150mm is required the metal shall be placed in layers of uniform thickness but no layer shall be in excess of 150mm.

The layers shall be so placed that when completed they will be true to the grades or levels required. The laying procedure shall be arranged to minimize segregation and the use of graders shall be restricted to essential shaping and final trimming with minimum working of the final surface.

Each layer of subbase and basecourse shall be compacted by multiple passes of either approved three wheel steel rollers, vibrating rollers or rubber tyred rollers.



Fine aggregate may be hand-spread in a comparatively dry state over any open-textured portion of the compacted basecourse surface. The fine aggregate shall be vibrated or rolled into the interstices of the basecourse, and the minimum volume of water added necessary for compaction to achieve a stone mosaic surface. On no account shall a skin of fines be allowed to form on the basecourse surface while it is being prepared for sealing or paving. The cost of this fine aggregate shall be borne by the Contractor.

### 3.8 DEFECTS TO BE MADE GOOD

Any weak patches or other localized defects which become apparent in the subgrade or in the basecourse itself during the compaction of the basecourse (except those defects which, in the opinion of the Engineer do not result from the Contractor's method of laying or compaction, or from the Contractor's construction of the subgrade) shall be excavated and made good with approved material at the Contractor's expense.

### 3.9 SURFACE FINISH

The construction of the basecourse layers shall be carried out in such a manner that when all free dust loose stones and other loose materials are swept from the surface it shall conform to the grades and typical cross-sections shown on the plans.

#### **Application – pavement surface**

### 3.10 CONSTRUCTION OF PAVEMENT SURFACE

A pavement surface of either a two coat seal or asphaltic concrete shall be constructed on the completed and approved basecourse in accordance with the drawings. Both surfaces are specified below but only one will apply to any section of road.

No pavement surface is to be applied or laid until the basecourse surface has been approved by the Engineer in writing and the Contractor has obtained all the approvals required from the Territorial Authority. If pavement surfaces are applied or laid before receiving such approvals the Engineer may, at his complete discretion, instruct the Contractor to lift the pavement surface and re-form the basecourse ready for approval in the normal manner.

The road surface shall not be fouled by water, oil, petrol or other droppings from construction plant or vehicles. If necessary trays or pans shall be fitted under trucks or other plant to prevent fouling of the road.

#### **Application – two coat chip seal**

### 3.11 TWO COAT CHIP SEAL

Note: Where differences occur between this Specification and the relevant Territorial Authority requirements the Territorial Authority requirements shall take precedence.

Two coat sealing shall be carried out in accordance with the requirements of all relevant TNZ Specifications and in particular with M/1:1995, M/6:2004, P/3:1995 First Coat Sealing and P/4:1989 AND 1995 except to the extent that these Specifications are extended or modified by the clauses set out below.



### 3.12 PREPARATION OF SURFACE FOR SEALING

Immediately prior to sealing, the surface shall be swept free from all chips, grit, detritus or other deleterious material. No sealing shall be applied to new areas until the surface has been inspected and approved by the Engineer.

First coat sealing shall be applied to an approved basecourse surface constructed in accordance with Section 3.5 and 3.7 of the Specification.

Second coat sealing shall only be carried out on a surface which has previously been first coat sealed. Any defective areas which have developed in the first coat seal are to be repaired to the approval of the Engineer using either asphaltic concrete or chip and bitumen penetration. Cutback binders which may affect the second coat seal binder shall not be used. All patching shall present a dense, waterproof surface so that the second coat seal will not be affected in any way.

Sealing binder for both first and second coat seals shall be 180–200 penetration grade bitumen fluxed and cutback in conformity with the TNZ Specification.

### 3.13 SEALING CHIPS

First coat and second coat sealing chips shall be as detailed on the drawings or as per Territorial Authority requirements unless otherwise specified by the Engineer, all in accordance with TNZ Specifications.

### 3.14 APPLICATION RATES OF SEALING BINDER

Unless stated in the schedule or the drawings the required application rates for sealing binder are to be adopted as follows:

First coat seal 1.2 litres/m<sup>2</sup>

Second coat seal 0.8 litres/m<sup>2</sup>

Membrane seal 1.0 litre/m<sup>2</sup>

The actual application rates shall be confirmed in writing with the engineer prior to works commencing.

### 3.15 REPAIR OF DAMAGE CAUSED BY RAIN

Chips whipped off or brushed from the surface owing to rain or the effects of rain, if clean and free from dirt, shall be broomed or spread back over the road and thoroughly rolled with a smooth wheeled roller during the hottest part of the day.

Any which cannot be made good in the manner described above shall be brought up to the required standard by a method approved by the Engineer. The repaired area shall be to the same standard as the adjacent seal.

If on completion of the repairs the seal does not comply with the required standard the Engineer shall instruct the contractor to apply a smoothing coat treatment over such an area.

Any remedial measures or repairs necessitated by weather conditions shall be at the Contractor's expense.

### 3.16 REMOVAL OF SURPLUS CHIPS

Unless otherwise instructed by the Engineer surplus chips are to be removed from the roadway within the times set out below:

First coat sealing – within 7 days of sealing

Second coat sealing – Immediately prior to the removal of the 30km/hr speed restriction signs

The removal of surplus chips carried out by careful hand brooming, by light rotary brooming, or suction. Every precaution shall be taken to ensure that chips which have made contact with the sealing binder are not removed or disturbed.

Surplus chips shall be disposed of off site by the Contractor unless the Engineer instructs otherwise. The cost of the removal and disposal of surplus chips shall be included in the Contractor's rate for sealing.

### 3.17 MAINTENANCE

The sealed roadway shall be maintained by the Contractor for the period which is stated within the Contract Documents.

The Contractor shall maintain, at his own cost and to the entire satisfaction of the Engineer, the roadway together with all intersections within the road reserve until the end of the maintenance period. At the end of the maintenance period the Contractor shall remove all surplus chips from the road surface, sumps and stormwater pipes and leave the whole area in a completed and tidy condition to the satisfaction of the Engineer.

### 3.18 PAYMENT

Clauses 29 of TNZ Specification P/3:1989 and 1995 AND Clauses 26 of TNZ Specification P/4: 1989 and 1995 do not apply. For payment conditions refer to the Schedule of Quantities.

## **Application – asphaltic concrete**

### 3.19 ASPHALTIC CONCRETE

Note: Where differences occur between this Specification and the relevant Territorial Authority requirements the Territorial Authority requirements shall take precedence.

Asphaltic concrete paving shall be carried out in accordance with the requirements of all relevant TNZ Specifications and in particular with M/10:2005 and P/9:1992 except to the extent that these Specifications are extended or modified by the clauses set out below.

### 3.20 ASPHALTIC BINDER

The asphaltic binder to be used in the mix shall be 180–200 grade bitumen complying with TNZ Specification M1:1995.

### 3.21 VARIATION TO NORMAL MIX DESIGN

When the asphaltic concrete will be constructed on areas where it is not possible by lack of space or other reason to use the compaction equipment specified in TNZ P/9, the mix shall be designed in accordance with TNZ M/10

but using 50 blow compaction. The Contractor must obtain the written approval of the Engineer for this modification to the normal mix design method.

### 3.22 DEPTH AND TYPE OF MIX

The Contractor shall ensure that the type of asphaltic concrete mix used and the depth laid is in accordance with the requirements shown on the drawings and required by the Territorial Authority.

### 3.23 MEMBRANE SEAL COAT

Before laying asphaltic concrete the prepared basecourse is to be sealed with asphaltic binder (suitably fluxed and cut back) to give a residual of 1 litre/m<sup>2</sup> of 180–200 bitumen over the whole area. The area shall not be trafficked unless, with the approval of the Engineer, a suitable grit or chip surfacing coat is applied to keep the seal intact. The period of time elapsed between the membrane seal coat and the layering of asphaltic concrete shall principally depend on the atmospheric conditions pertaining at the time of sealing and the Territorial Authority requirements. This can range from 2–3 days to 4 weeks. The Contractor shall make himself conversant with these conditions.

### 3.24 SWEEPINGS

Prior to any membrane seal, or first coat seal taking place, the whole of the road shall be swept as in 3.12 to remove all the loose fines and dust. This material shall be swept into the channel, and removed by sucker truck. On no account are the fines to be thrown onto the berm.

## SECTION 600 CONSTRUCTION OF KERB AND CHANNEL

---

### TABLE OF CONTENTS

<b>1 GENERAL.....</b>	<b>2</b>
<b>Related Work.....</b>	<b>2</b>
1.1 RELATED SECTIONS .....	2
<b>Documents.....</b>	<b>2</b>
1.2 REFERENCED DOCUMENTS.....	2
<b>2 PRODUCTS.....</b>	<b>2</b>
<b>Materials.....</b>	<b>2</b>
2.1 CONCRETE.....	2
<b>3 EXECUTION.....</b>	<b>2</b>
<b>Conditions.....</b>	<b>2</b>
3.1 LINE AND LEVELS .....	2
3.2 PROFILES .....	3
<b>Application.....</b>	<b>3</b>
3.3 PLACING CONCRETE.....	3
3.4 PRECAST CONCRETE KERB BLOCKS .....	3
3.5 CAST IN SITU KERB .....	3
3.6 MACHINE LAID KERB AND CHANELLING (EXTRUDED) .....	3
3.7 FORMWORK.....	4
3.8 REINFORCEMENT .....	5
3.9 100 DIAMETER STORMWATER OUTLETS.....	5
3.10 FOUNDATIONS .....	5
3.11 UNDERCHANNELS DRAINS .....	5
<b>Finishing.....</b>	<b>5</b>
3.12 SURFACE FINISH .....	5



## SECTION 600 CONSTRUCTION OF KERB AND CHANNEL

---

### 1 GENERAL

This specification covers the necessary excavation to the requisite alignment, levels and gradient, the supply of materials and the construction of the specified type of kerbing and channelling.

#### Related Work

#### 1.1 RELATED SECTIONS

Refer to Section 500 for Road Construction

Refer to Section 700 for Construction of Concrete Footpath, Vehicle Crossing and Accessway.

#### Documents

#### 1.2 REFERENCED DOCUMENTS

Documents referred to in this section are:

NZS3104:2003 Specification for concrete production

NZS3109:1997 Concrete Construction

NZS4404:2004 Land Development and Subdivision Engineering

Note: Documents listed above and cited in the clauses that follow are part of this specification. Where differences occur between this Specification and the relevant Territorial Authority requirements the Territorial Authority requirements shall take precedence.

It is the responsibility of the contractor to be familiar with the materials and expert in the techniques quoted in these publications.

### 2 PRODUCTS

#### Materials

#### 2.1 CONCRETE

Prescribed mix to NZS3104 (except where specified otherwise)

Haunching concrete: 17.5MPa

Other concrete: 25MPa

### 3 EXECUTION

#### Conditions

#### 3.1 LINE AND LEVELS

It is the Contractor's responsibility to set out the kerb carefully to the line and levels as shown on the typical cross-sections and long sections. The kerbs shall be laid true and straight between tangent points, and on curves shall sweep evenly without kinks, flats, or angles. The Engineer shall be advised

before any precast kerbs are stood, or machine laid kerb and channel poured and shall be given the opportunity to inspect the pins.

The levels on the plan shall be strictly adhered to except at intersections where slight adjustments shall be made if necessary so that the finished work shall present a workmanlike appearance to the eye.

### 3.2 PROFILES

To relevant Territorial Authority requirements where required or to NZS4404, figure 3.12. Otherwise refer to drawings for profiles of in situ kerbs and in situ channels.

### Application

### 3.3 PLACING CONCRETE

The concrete shall be poured continuously up to the construction joints, which are to be formed at right angles to the kerb line. The contractor is to take care that no shock or vibration shall reach the concrete after placing until it is set. In particular, where it is possible that rain drops may mark the surface of the concrete before it has taken the initial set, the surface of the concrete shall be covered with supported polythene film, or similar, to ensure that the concrete is not marked.

Expansion joints shall be placed at not more than 3.0m intervals. All concrete must be placed in sufficient time at the end of a day's work to allow proper finishing off and protection before dark.

### 3.4 PRECAST CONCRETE KERB BLOCKS

These shall conform to the pattern shown on the standard detail drawings, and shall be either vertical or mountable as shown on the plans. All kerbs used shall be made from metal aggregate and have a minimum crushing strength of 25MPa. All blocks used shall be free from any cracks, chips or other defects.

The blocks shall be bedded and haunched on concrete in an approved manner. The joints between blocks shall be filled and neatly pointed with a 2:1 sand cement mortar.

### 3.5 CAST IN SITU KERB

Cast in situ kerbing shall conform in all respects with the detail shown on Standard Detail Sheet. The tops of the kerbing shall be neatly trowelled to give a smooth surface and a chamfer as shown.

### 3.6 MACHINE LAID KERB AND CHANELLING (EXTRUDED)

The kerb and channel may be constructed, with the approval of the Engineer, by the use a kerb forming machine. Concrete placed by the kerb machine shall be of such consistency that after extrusion, it will maintain the shape of the kerb section without support. It shall contain the maximum amount of water that will permit this result without impairing the strength.

The grade for the top of the kerb shall be indicated by an offset guideline set by the Contractor from survey reference marks shown on the drawings. The forming tube portion of the extrusion machine shall be readily adjustable

vertically during the forward motion of the machine to provide when necessary, a variable height of kerb and channel conforming to the predetermined kerb grade. A grade line gauge or pointer shall be attached to the machine in such manner that a continual comparison can be made between the kerb being placed and design kerb grade as indicated by the offset guideline. In lieu of the above method for maintaining the kerb grade, the extrusion machine may be operated on rails or forms set at uniform depth below the predetermined finished top of the kerb grade.

Concrete shall be fed to the machine at a uniform rate. The machine shall be operated under sufficient uniform restraint to forward motion to produce a well compacted mass of concrete free from surface pits larger than 5mm in diameter and requiring no further finishing, other than light brushing with a brush filled with water only.

Finishing with a brush application of grout will not be permitted. Construction joints shall be constructed at 30m intervals by sawing through the kerb section to its full depth. The width of the cut shall be such as to admit bituminous fabric joint filler with a snug fit.

If sawing is performed before the concrete has hardened, the adjacent portions of the kerb shall be supported firmly with close fitting shields. The operations of sawing and inserting the joint filler shall be completed before curing the concrete.

If sawing is performed after the concrete has hardened, the joint filler shall be grouted in place with heavy trowel pressure. The exposed faces of the kerb in the vicinity of the joint shall be flooded with curing compound.

Construction joints shall be constructed at a maximum spacing of 4 metres and may be made by cutting, sawing or pre-forming.

Curing shall conform to the provisions in the separate concrete specification. At the conclusion of the curing period the filler in each joint shall be checked for tightness of fit. The loose filler in any joint shall again be grouted in place and cured.

### 3.7 FORMWORK

All formwork for cast-in-situ concrete shall be braced and of such strength and stiffness so as to safely support the loads imposed on it without any perceptible deflection, and such that removal can be carried out without damage to the green concrete.

The formwork shall be built such that it is close jointed and grout tight. Before any forms are used again, they shall be thoroughly cleaned and coated with an approved form release oil. This shall be done before the formwork is placed in position, so that no oil may get into any reinforcement (if any) in the channel.

Formwork for curved channelling shall be made a true curve by springing the timber. Short lengths of straight shall not be allowed. The formwork supporting the sides of channelling shall not be removed for at least 48 hours in low temperature weather. The concrete shall then either be sprayed with an approved curing compound, or kept continuously damp for 7 days.

### 3.8 REINFORCEMENT

Reinforcement shall only be placed in the channel after the Engineer has inspected the foundation and ordered reinforcing necessary.

### 3.9 100 DIAMETER STORMWATER OUTLETS

The Contractor shall construct where shown on the plans 100mm diameter stormwater drainage outlets to the face of the kerb as indicated.

### 3.10 FOUNDATIONS

All kerb and channelling shall be constructed on a basecourse or subbase foundation as described in Specification "ROAD CONSTRUCTION" clause 3.6. Where the foundation is filling, the Engineer's approval shall be obtained before the concrete is poured.

### 3.11 UNDERCHANNELS DRAINS

An under channel drain shall be provided as shown on the standard detail drawing, or as per the Territorial Authority requirements.

Pipe used shall be high density Polyethylene, with a double corrugated profile such as "Novaflow", or approved equivalent. Clay field tiles shall not be used except with the express permission of the Engineer. Unless specified otherwise by the Territorial Authority drainage material shall be 20/7 grade scoria. Filter sock shall be installed to under channel pipework if required by the Territorial Authority

Note that the position of the under channel drain relative to the channel and the size of the drainage, pipe and the filter media all vary depending on the requirements of the Territorial Authority. The Contractor is to make himself fully conversant with the Territorial body requirements as shown on the design drawings.

## Finishing

### 3.12 SURFACE FINISH

When the boxing is stripped, all concrete must show a good finish. Any sections which show serious honey-combing or air bubbles shall be cut out and re-laid to the Engineer's approval. Small blemishes may be pointed up with mortar only after the Engineer has inspected it. The top of the channelling shall be floated over before the concrete has finally set with a tool to give a true smooth surface. The outside edge of the channelling shall be given a uniform chamfer of 20mm.



## SECTION 700 CONSTRUCTION OF CONCRETE FOOTPATH, VEHICLE CROSSING AND ACCESSWAY

---

### TABLE OF CONTENTS

<b>1</b>	<b>GENERAL.....</b>	<b>2</b>
	<b>Documents.....</b>	<b>2</b>
1.1	REFERENCED DOCUMENTS.....	2
<b>2</b>	<b>PRODUCTS.....</b>	<b>2</b>
	<b>Materials.....</b>	<b>2</b>
2.1	CONCRETE.....	2
2.2	REINFORCEMENT .....	2
<b>3</b>	<b>EXECUTION.....</b>	<b>3</b>
	<b>Application.....</b>	<b>3</b>
3.1	FOUNDATIONS .....	3
3.2	FORMWORK .....	3
3.3	PLACING CONCRETE.....	3
3.4	SCREEDING .....	3
3.5	FINISHING.....	3
3.6	CONTRACTION JOINTS .....	4
3.7	PROTECTION OF CONCRETE .....	4
3.8	VEHICLE CROSSINGS .....	4
3.9	PRAM CROSSINGS .....	4
3.10	WATER VALVES .....	4
3.11	PEDESTRIAL ACCESSWAYS.....	4
3.12	STORMWATER OUTLETS.....	4



## **SECTION 700 CONSTRUCTION OF CONCRETE FOOTPATH, VEHICLE CROSSING AND ACCESSWAY**

---

### **1 GENERAL**

This specification covers the rolling of the prepared subgrade material, placing and rolling of the subbase material and pouring of the concrete footpath, vehicle crossings and accessway to the levels and positions as shown on the drawing.

#### **Documents**

##### **1.1 REFERENCED DOCUMENTS**

Documents referred to in this section are:

NZS3104:2003	Specification for concrete production
NZS3109:1997	Concrete Construction
NZS4404:2004	Land Development and Subdivision Engineering
AS/NZS4671:2001	Steel Reinforcing Materials

Note: Documents listed above and cited in the clauses that follow are part of this specification. Where differences occur between this Specification and the relevant Territorial Authority requirements the Territorial Authority requirements will take precedence.

It is the responsibility of the contractor to be familiar with the materials and expert in the techniques quoted in these publications.

### **2 PRODUCTS**

#### **Materials**

##### **2.1 CONCRETE**

Concrete for footpaths, vehicle crossings and accessways shall be not less than 20MPa concrete supplied from a registered concrete production facility and cured for 28 days.

If required, exposed aggregate surface shall be constructed as per the Territorial Authority requirements.

##### **2.2 REINFORCEMENT**

Reinforcing bars shall comply with the requirements of AS/NZS4671 for the size and grade of bars detailed on the drawings.

Welded wire fabric for reinforcement shall comply with the requirements of AS/NZS4671.

The engineer's representative shall be notified 24 hours prior to pouring to inspect the reinforcing before the concrete is poured.

### **3 EXECUTION**

#### **Application**

##### **3.1 FOUNDATIONS**

The subgrade of the footpath shall be trimmed to a total depth below the finished level of the path as indicated on the typical cross sections. It shall be of an even grade, line and crossfall, and shall not deflect unduly when rolled with a suitable sized vibrating roller.

Any area weaving under the roller shall be removed and replaced with approved hardfill at the Contractor's expense. Fine scoria, sand, or other approved material shall be rolled to the compacted depth shown on the drawings on top of the subgrade.

It is important in dry weather that the sand or scoria bedding is thoroughly wetted just prior to the concrete being poured.

The Engineer's approval to the subgrade must be obtained before any concrete is placed.

##### **3.2 FORMWORK**

Formwork used may be of wood or steel. It shall be stiff enough and sufficiently well braced to prevent any perceptible bulging at the sides. All forms must be perfectly straight in line, true to grade, and cleaned after every use. The formwork shall be easily removed so as not to disturb the green concrete.

##### **3.3 PLACING CONCRETE**

Concrete must be either poured straight from concrete trucks or deposited from barrows, and wheeling planks used to protect the subgrade from the wheels. All concrete must be shovelled into position and not raked. Construction joints shall be placed at not more than 3.0m intervals.

Mixing and placing of concrete shall be finished sufficiently early at the end of a day's work to allow for proper finishing off and protection of the green concrete.

Precautions must be taken to protect the green concrete against rain, children, and animals, or anything else liable to mark the surface.

##### **3.4 SCREEDING**

Concrete shall firstly be roughly levelled with a shovel. Screeding shall then be carried out by tamping the screed up and down the surface, and then moved forward by a combination of a longitudinal and transverse motion. Care shall be taken that there is always an excess of concrete in front of the screed.

##### **3.5 FINISHING**

After the screeding has taken place and the concrete has "gone off" slightly, the surface shall be floated off with a wooden float. After this, the concrete shall be lightly broomed across the path to provide a non-slip surface. When a 3m straight edge is placed along the path, there shall be not more than 5mm discrepancy along its length.

### 3.6 CONTRACTION JOINTS

Contraction joints shall be sawcut into the footpath no more than 24 hours after pouring. Sawcuts shall be 25% of the depth of the footpath. Any other method of controlling contraction cracking shall first have the Engineer's approval.

### 3.7 PROTECTION OF CONCRETE

The freshly poured concrete shall be covered with sacks, hessian, polythene or sand dams and kept damp for at least 7 days after pouring. Alternatively, the Contractor may spray an approved curing compound after the concrete has taken its initial set.

### 3.8 VEHICLE CROSSINGS

Vehicular crossings shall be constructed to the dimensions indicated where shown on the drawings and to relevant Territorial Authority standards.

The concrete is to be thickened up as indicated on the drawings, on bedding composed of fine scoria or sand, and shall extend from the kerb line to the boundary. No payment will be made for any footpath over the width of vehicular crossing.

The whole of the crossing is to be constructed as shown on the Standard Detail drawing.

### 3.9 PRAM CROSSINGS

- (a) Where the footpath does not adjoin the kerb, the crossing shall be to the width as shown on the detail and shall be constructed to the kerb lines at all street intersections. The footpath shall be extended to join them.
- (b) Where the footpath adjoins the kerb, the crossing shall be constructed as on detail sheet. Radius blocks shall be placed at either end.
- (c) Installation of tactile indicators shall comply with "Land Transport New Zealand RTS 14 Guidelines for installing pedestrian facilities for people with visual impairment" and NZS/AS1428.4:2002 "Design for access and mobility".

### 3.10 WATER VALVES

Where sluice valves occur in the footpath, they shall be brought level with the surface of the path, and neatly set flush with the surface of the concrete.

### 3.11 PEDESTRIAL ACCESSWAYS

Where accessways are shown on the plan, they shall be constructed as for a concrete path for the width indicated on the plans. The formation is to be carried out for the full width of the accessway and the berms on either side of the concrete path, topsoiled and grassed.

### 3.12 STORMWATER OUTLETS

Where 100mm diameter stormwater outlets occur under the footpath they shall be constructed in a precast block consisting of a 150mm length of precast path, with a 100mm diameter hole.

## SECTION 800 STORMWATER AND SEWER DRAINAGE

---

### TABLE OF CONTENTS

<b>1 GENERAL</b> .....	<b>2</b>
<b>Documents</b> .....	<b>2</b>
1.1 REGULATIONS AND BYLAWS .....	2
<b>Definitions</b> .....	<b>2</b>
1.2 GRANULAR BEDDING MATERIAL.....	2
1.3 SEWER DRAIN .....	3
<b>Performance</b> .....	<b>3</b>
1.4 SAFETY .....	3
<b>2 PRODUCT</b> .....	<b>3</b>
<b>Materials</b> .....	<b>3</b>
2.1 MATERIALS .....	3
<b>3 EXECUTION</b> .....	<b>4</b>
<b>Conditions</b> .....	<b>4</b>
3.1 INSPECTION OF SITE .....	4
3.2 REPRESENTATIVE ON SITE.....	5
3.3 PERMITS AND INSPECTIONS .....	5
3.4 MEASUREMENTS .....	5
3.5 CONNECTIONS TO EXISTING SEWERS AND DRAINS .....	5
3.6 COVER TO SEWERS.....	5
3.7 STORMWATER OUTLETS.....	6
3.8 ASBUILT PLANS.....	6
3.9 BACKFILLING TO ROAD CROSSINGS .....	6
3.10 UNSUITABLE FOUNDATION MATERIAL .....	6
3.11 CCTV INSPECTIONS .....	6
3.12 RESTORATION .....	7
<b>Application</b> .....	<b>8</b>
3.13 SETTING OUT .....	8
3.14 EXCAVATION .....	8
3.15 BEDDING .....	9
3.16 LAYING AND JOINTING .....	10
3.17 MANHOLES, JUNCTIONS AND STRUCTURES.....	11
3.18 ACCESS SHAFTS/CHAMBERS .....	12
3.19 BACKFILLING .....	14
<b>Application – testing</b> .....	<b>14</b>
3.20 GENERAL .....	14
3.21 METHODS OF TEST .....	15
3.22 WATER TEST .....	15
3.23 LOW PRESSURE AIR TEST.....	16
3.24 HIGH PRESSURE AIR TEST.....	16
3.25 TESTING BEFORE BACKFILLING.....	16
3.26 TESTING AFTER BACKFILLING .....	16
APPENDIX A .....	18
APPENDIX B .....	19



## **SECTION 800 STORMWATER AND SEWER DRAINAGE**

---

### **1 GENERAL**

This specification sets out requirements for laying underground stormwater drains and sewer pipes, together with associated manholes, junctions, headwalls and other structures shown on the drawings. All work in private property shall comply with minimum requirements of the New Zealand Building Code.

The contractor shall supply all plant, materials, labour and supervision necessary to complete the work in accordance with this specification.

The pipes may be ceramic, concrete, cast iron, steel, unplasticised polyvinyl chloride (UPVC), glass reinforced polyester, polyethylene (PE) or other materials approved by the engineer and the Territorial Authority.

Where a Standard or manufacturer's literature is available which specifies the use of a particular type of material, such sources should be used for supplementary information.

### **Documents**

#### **1.1 REGULATIONS AND BYLAWS**

The requirements of this standard specification shall be read subject to any applicable statute, regulation and bylaws, including without limitation:

Building Act 1991

Drainage and Plumbing Regulations 1978

Health and Safety in Employment Act 1992 (Amendments 2002)

Health and Safety Regulations 1995

Territorial Authority Engineering Standards

Local Government Act 1974 and 2002

Plumbers, Gasfitters and Drain layers Act 1976

Resource Management Act 1991

Note: Documents listed above and cited in the clauses that follow are part of this specification. Where stormwater and sewer drainage are to become Public Assets any difference between this specification and Territorial Authority requirements, the Territorial Authority requirements shall take precedence.

### **Definitions**

#### **1.2 GRANULAR BEDDING MATERIAL**

The granular material for bedding, shall be hard clean, chemically stable crushed stone or crushed concrete. Acceptable grading for the granular material shall be as per the relevant Territorial Authority requirements.

In addition, the material shall satisfy the requirements for "compaction fraction" and "ease of compaction" set out in appendix A.

### 1.3 SEWER DRAIN

In this Standard, unless consistent with the context, any pipeline constructed or laid underground to convey sewage, effluent or stormwater which is vested in a Territorial Authority, or is under the control of, or maintenance by a Territorial Authority.

### Performance

#### 1.4 SAFETY

All works involving excavation works & any other associated works must comply with all requirements in the Health and Safety in Employment Act 1992 and HSE Regulations. These works are administered by Occupational Safety and Health Services (OSH) under the Department of Labour.

Approved Code of Practice for Safety in Excavation and Shafts for Foundations under section 20 of the Health and Safety in Employment Act 1992 is a statement for the preferred work practices for the purpose of ensuring health and safety of persons and any other persons affected by the activities covered in this standard code.

Where the “depth of trench” is more than 1.5m deep and it is deeper than it is wide at the top, it is deemed as “Notifiable Works” and must be notified to the Inspector under the Health and Safety Regulations 1995, by the contractor and evidence supplied to the engineer if requested. A form for this purpose is available from all OSH offices. The fact that any work is non notifiable does not exempt that work from any of the safety or welfare provisions of the Act.

Collapse of a trench face may be caused by loads on the surface near the trench. The regulations specify that unless the trench face is “timbered” mechanical plant, vehicles or heavy loads shall not be permitted to approach closer to the trench than what would be the edge of the face if cut to a “safe slope”. They also state that excavated or other loose materials shall not be placed closer than 600mm from the edge of the trench.

The Contractor shall be responsible for providing support to all excavations and for falsework and formwork and shall conform to best safety practices and codes of practice issued by the Department of Labour (OSH).

The regulations require that precautions to be taken to prevent material from rolling into the trench. On sliding slopes excavated material shall be placed only on the lower side of the slope.

Where laser alignment equipment is used, the safety requirements set out in Part 2 of NZS5821 shall be observed.

## 2 PRODUCT

### Materials

#### 2.1 MATERIALS

Unless otherwise specified, the contractor shall supply and deliver to the site all pipes, precast manholes, granular bedding material and other materials

required for incorporation in the work. Materials shall be new, of good quality and free of defects.

Pipes shall comply with one of the following standards or such other standard as the Engineer approves:

- a) Ductile Iron : AS/NZS2280
- b) Ceramic : BS EN295;
- c) Concrete : AS/NZS4058, AS/NZS3725;
- d) Steel : NZS4442
- e) UPVC : AS/NZS1477; AS/NZS1254; AS/NZS1260
- f) PE : AS/NZS4130; AS/NZS4131; AS/NZS5065

The type of pipe along with its diameter and strength class shall be as defined in the drawings or elsewhere in the contract documents.

Any pipes not specified as to strength class shall meet the following minimum standards whether being used for sewer or stormwater

- Concrete pipes – minimum strength standard – class 2
- PVC pipes – minimum strength standards; sewer grade heavy duty class SN16; stormwater  $\leq$  DN 150–SN16; greater than DN150–SN8

Concrete precast manholes shall comply with NZS3725; NZS3109 with surface finishes to NZS3114 and shall be of diameter 1050mm unless specified otherwise. Insitu concrete for all drainage works shall be a minimum of 20MPa unless specified otherwise on the drawings or in the particular requirements of the specifications.

Some standards specify alternative wall thicknesses for a given pipe diameter. In all cases the material and wall thickness selected shall be adequate to resist the actual soil and other loads. For determining such loads, reference should be made to NZS3725 and AS/NZS2566. Reference to AS/NZS 4058:2007 Section 2.4 Joint Materials shall comply with AS1646..

Concrete for the use as bedding material and concrete structures in sanitary sewer and stormwater drainage works shall comply with the requirements specified in NZS3109 and Territorial Authority Standards.

Other materials used for bedding and the first stage of back fill up to a level of 300mm above the crown of the pipe shall comply with the requirements of this Standard and shall be free from large stones having a dimension exceeding 40mm, tree roots, coarse rubbish and vegetable matter.

### 3 EXECUTION

#### Conditions

##### 3.1 INSPECTION OF SITE

Before tendering, the Contractor shall visit the site of the works and shall carry out a thorough inspection in order to ascertain the nature of the work, the conditions of the various properties and the amount of restoration required to complete the works. On no account will any additional amount be



paid for work necessitated through the failure of the Contractor to adequately inspect the site before tendering.

### 3.2 REPRESENTATIVE ON SITE

Throughout the term of the Contract the Contractor shall have a competent person in charge of operations, who will be responsible for supervising the work and who shall see that all statutory provisions are complied with. The Contractor's representative shall be responsible for seeing that all instructions of the Engineer are carried out promptly, and shall be responsible for the safe custody of a complete set of plans and specifications which must be available for inspection on the site of the works at all times.

The Contractor shall advise the Engineer of the name of his representative before commencing the contract, and the contractor's representative shall not be changed without the Contractor first obtaining the consent of the Engineer.

### 3.3 PERMITS AND INSPECTIONS

The Contractor shall take out all necessary permits to conform to the By-Laws of the Territorial Authority concerned. All inspections by the Territorial Authority Officers shall be arranged by the Contractor and any costs incurred through inspections, permits, connections, restoration of Public Property, shall all be paid by the Contractor.

### 3.4 MEASUREMENTS

For the purposes of arriving at the amount of progress payments the length of the sewers laid will be measured along the pipeline to and from the centres of manholes or lamp holes. The through measurement will include main pipes for all junctions over the cost of plain pipes.

The Contractor shall also provide, free of charge, all labour and materials required by the Engineer to measure up the work, to check the accuracy of the lines and levels, to check the position of house connections, to measure the completed work, and to make any test that the Engineer may require.

### 3.5 CONNECTIONS TO EXISTING SEWERS AND DRAINS

As soon as any sewer or drain has been inspected and tested and approved by the Engineer and Territorial Authority, the Contractor shall arrange for the new work to be connected into the existing reticulation. In doing so, the Contractor shall comply with all Territorial Authority requirements and be responsible for any costs incurred.

The Contractor shall not connect any pipes to an existing sewer or manhole until permission is granted by the appropriate Regional Council or Territorial Authority. This permission will only be granted after the new sewers have been successfully tested and passed to the Territorial Authority's satisfaction.

### 3.6 COVER TO SEWERS

Pipelines shall have minimum cover in accordance with the relevant Territorial Authority requirements. Where the Territorial Authority does not have specific requirements, the minimum covers may be used as described in AS/NZS3725.

Where minimum cover cannot be achieved, additional protection is required, which requires specific design and approval.

### 3.7 STORMWATER OUTLETS

The Contractor shall construct at the outlets to all stormwater sewers concrete wing walls and aprons. These shall be constructed in 40Mpa concrete where shown on the drawings and to the dimensions as shown in the standard details sheet.

### 3.8 ASBUILT PLANS

The Contractor shall upon completion of the works deliver to the Engineer "As Built" plans showing the position of all pipes, manholes junctions, connections and specials installed upon this job. The Engineer will supply further copies of the contract plans for this purpose when required. The Contractor shall supply the Asbuilts in electronic and hardcopy format. Where the Asbuilts are for public infrastructure the Asbuilts shall be delivered in a format acceptable to the Territorial Authority.

The work will not be considered as complete until this has been done to the Engineer's satisfaction and the certificate of Substantial Completion will not be issued until this information has been received.

Manholes and pipe ends will be located by the Engineer relative to section boundary positions. In the Contractor's "As Built" the length of each pipe and the distance from the downstream manhole of all junctions or saddles must be shown and the end of 100mm connections must be shown in relation to the main pipeline. Should the Contractor fail to do this he may be liable for any costs incurred at a later date in uncovering the junction and connections.

### 3.9 BACKFILLING TO ROAD CROSSINGS

The Contractor shall where indicated on the drawings or instructed by the Engineer place hardfill backfill over the top of the pipe to all carriageway crossings, either existing or proposed. Material for this purpose shall be road sub-base, or equal, approved by the Engineer.

The width of the trench for payment purposes shall be a minimum of 500mm or the O.D. of the pipe plus 300mm, whichever is the greater. This Clause shall also apply to hardfill backfill to Water Reticulation crossings and ducts for utility services.

### 3.10 UNSUITABLE FOUNDATION MATERIAL

The Contractor may encounter unsuitable foundation material in the trench at the bedding level. This material shall be excavated, and replaced with hardfill material, which shall be paid for at the appropriate rate in the Schedule. The Engineer shall agree with the Contractor before the work commences, the extent of this removal. The Contractor shall at all times keep suitable records of locations of additional bedding placed.

### 3.11 CCTV INSPECTIONS

All stormwater and sewer mains shall, prior to the issue of the Practical Completion Certificate, be inspected by means of CCTV camera. A DVD format record of each main shall be made with the video correctly zeroed at the starting manhole such that all connections, manholes etc show at their correct position in the pipeline.

A summary screen with parameters as in accordance with NZWWA New Zealand Pipe Inspection Manual shall precede the recording of each pipeline

The DVD recording shall be accompanied by a written record which shall include annotated condition coded sheets (to NZWWA requirements) for every length of pipeline constructed. These shall include the above details and photographs of any faults located. The written record shall be clearly written so that it can be utilised if necessary without parallel recourse to the video recording

Any evidence of poor materials or workmanship shall be made good by the contractor without further charge to the principal.

Where unsatisfactory work is identified and remedied a new CCTV inspection and video shall be provided at the contractors expense.

A minimum of two copies of the CCTV inspection with video and written records shall be provided to the engineer, one set for the engineer's record, the other set to be forwarded to the relevant Territorial Authority with final "asbuilts".

### 3.12 RESTORATION

After sufficient time has elapsed for the settlement of backfilling, the Contractor shall, where practicable, restore all disturbed ground, outside the road reserve to its original condition. In areas of excavation, this will mean smoothing off the backfill material to an even surface that will not trap rainwater, and then spreading a minimum of 150mm of topsoil over the disturbed area. Only the cover of the manhole shall be visible, the ground around it being neatly contoured and topsoiled.

The rate that the Contractor has tendered for the work shall allow fully for the restoration of all areas that have been disturbed by pipe laying operations. These areas shall be restored to the same standard before the work commenced or to the specification for top soiling and grassing on berms and batters, whichever is the higher.

Where the pipeline is to be laid through bush and scrub, the Contractor shall in all cases clear a sufficiently wide track to allow for the Digger, and excavated material to be placed clear of fallen or standing bush. All the bush and scrub which has been bulldozed to clear track shall be removed from the site, completely burnt or mulched on site. When the Contractor has finished, the whole of the disturbed area shall be clean and tidy. Where the bush is of a sufficiently high quality, then the Contractor shall limit the extent of his clearing to an absolute minimum to carry out the work efficiently. The Engineer shall determine before any work is carried out whether or not the bush is worth saving.

All surplus materials shall be disposed of as directed by the engineer.

## Application

### 3.13 SETTING OUT

Pipes shall be aligned to grade by use of one of the following methods, or as specified by the Engineer.

- (a) Boning rods.
- (b) Laser alignment equipment.

For laying with boning rods, the boning rod should be accurately made in round-figure lengths and provided with a suitable projection or shoe at the lower end to rest on the invert or top of the barrel of the pipe being laid, as directed by the Engineer. Non-rigid pipes should be levelled by boning off the crown of the pipe at approximately 2m intervals. Boning rods should also be provided with a cross piece for alignment with top edges of the sight rails. The sight rails or bars should be painted in alternative colours, e.g. white, black, white, and have a straight top edge. They shall be firmly support and set horizontally at the required levels by instrument levelling from pegs. The spacing sight rails shall not be greater than 30m apart and there shall be a minimum of three sight rails in use in any one line or grade at anytime.

For laying with laser alignment equipment, the equipment and its use shall comply with Part 2 of NZS 5821. The equipment shall be self-levelling within a range of plus or minus one degree with a warning indication if the system is off-grade by more than 1mm in 10m. The equipment should be robust and suitable for construction application and should be protected from the effects of vibrations. Regular checks shall be made to ensure:

- (a) That the light beam is on grade
- (b) That the light beam is on line
- (c) That the beam is set at the correct level above the invert of the drain to be laid.

Although not generally specified, the pipeline may be laid to a curved alignment in special circumstances as approved by the Engineer or the Territorial Authority. The pipe manufacturer's recommendations regarding angular deflection at joints or allowable curvature of the pipe barrel shall be observed at all times.

The Contractor shall set out works in accordance with the contract drawings. No alterations in alignment, level or location of the drains, surface openings and fittings are to be made unless authorised by the Engineer.

### 3.14 EXCAVATION

Unless otherwise specified, the Contractor shall be responsible for dismantling fences removal of trees and vegetation, and any other clearing required in connection with the drainage works. Wherever possible, plants and materials shall be preserved for reinstatement after works have been completed. Topsoil shall be kept separate from other excavated material

Before any excavation is commenced in a public street or road the appropriate Territorial Authority shall be advised and its requirements ascertained. In all cases the position and depth of all existing underground services in the Territoriality, including telephone, electric power cables, gas or any other

underground service, shall be ascertained from the appropriate authority as accurately as possible. All necessary steps shall be taken to prevent damage to or accident arising from interference with such services. Any leaks or fractures discovered or damage caused shall be reported immediately to the engineer and Territorial Authority concerned.

The minimum width of the trench should be such that the barrel of the pipe is not closer than 150mm to the trench wall or timbering. Where unsuitable materials occur, the sides of the excavation shall be supported by suitable timbering and placed such that no interference with pipe laying or associated works occurs.

If road material is to be re-used as backfill material, care shall be taken to prevent contamination with other soils.

Where poor ground is encountered within the foundation and in the opinion of the Engineer, additional founding material is necessary, extra depth shall be excavated and additional foundation shall be constructed as directed by the Engineer. This additional excavation and foundation work should it be encountered will be paid for as an extra at schedule rates predetermined.

Where rock is encountered, extra payment will be made for the excavation of this rock at rates agreed between the Contractor and Engineer prior to the excavation works proceeding. Rock materials shall be defined as is described in Section 400– Earthworks Specification: clause 2.1 (b) (c) and (d). The use of explosives shall not be used without the prior approval of the Engineer.

The Contractor shall keep the excavation free from water/subsoil water at all times and shall provide all such pumping plant and drainage systems as may be deemed necessary for this purpose. All costs whatsoever, in connection with keeping the excavations free from water are to be borne by the Contractor.

### 3.15 BEDDING

The effective life of a pipeline depends very largely on uniformity of support. Each pipe shall be evenly and uniformly supported along the length of its barrel by suitable fill material in the various support zones. Irrespective of the method of bedding used, suitable recesses shall be provided in the supporting materials including the foundation to ensure that no bearing occurs at the pipe joints and protruding sockets.

Unless otherwise detailed in the specific contract documents or to an appropriate standard as approved by the Engineer, all bedding material shall satisfy the requirements in AS/NZS 3725 and manufacturer's specifications.

Where flexible jointed pipes are bedded in concrete or reinforced concrete, the bedding should provide a transverse expansion/movement joint. These should occur at each pipe joint.

The use of plain concrete or reinforced concrete to “slab-over” or partly surround the upper segment of a buried pipeline improves its load-carry capacity and assists in preventing crushing of the pipeline.

Where material of the trench bottom is suitable as bedding, the trench should preferably be over-excavated by the required depth of bedding and the material replaced and thoroughly compacted. This is generally necessary because in-situ material is likely to be variable, hence uneven loading of the pipe could result.

The bedding of each pipe shall be well compacted at the required grade and level. Care shall be taken to ensure that no cavities are left under the pipe barrel and that the bedding is not disturbed when trench timbering or construction shields are removed. Socket holes, if required, shall be formed in the bedding material of sufficient size to permit jointing of the pipe, and allow the pipe barrel to rest firmly on the bedding over its entire length.

A compacted granular bedding and surround shall be used where specified and where excavated material is unsuitable for use as “selected compacted fill”, or where the depth of the trench or super-imposed loading require the load-carrying capacity of the pipeline to be increased.

To prevent granular bedding material from acting as a drainage path for subsoil water after completion of the pipeline, particularly on steep gradients, impermeable water stops should be provided at suitable intervals. Where concrete is used for this purpose, care shall be taken to ensure that the pipeline is well supported on each side of the barrier. Alternatively, to keep the bedding in tact on steep gradients, use of cement-bonded granular bedding (in effect, a no-fines weak concrete) should be considered, but subject to use with flexible jointed pipes, bedding should be interrupted at each joint by a spacer of soft board or by some other method approved by the engineer, or the bedding designed to allow for consequent loss of flexibility of the pipeline. Concrete bedding should only be used to distribute loading of the pipeline where the pipes are laid on steep gradients. Its use is not recommended for non-rigid pipes.

### 3.16 LAYING AND JOINTING

All pipe works and any works associated shall be carried out and supervised by personal qualified or assessed by a suitable training course. All pipes shall be laid in accordance with relative standards, the manufactures instructions and good trade practices.

No pipe laying or placement of bedding material may commence until the trench foundation has been inspected by the Engineer and approval granted to proceed with works.

Each section of pipe shall be individually laid true to line and grade.

Pipe jointing shall be carried out in such a manner that the finished joints are water tight and present a smooth invert surface. For concrete pipes the spigot and inside of the socket and including the rubber ring shall be clean and free of debris before jointing. Care shall be taken not to damage pipes during jointing.

Refer to relevant clauses of NZS 7643 for jointing of uPVC pipes to pipes of different materials.

Other types of joints used in laying pipes shall be made in accordance with the manufacturer's instructions.

For sanitary sewers, the lower downstream end of each pipe section of the works shall be plugged in a water tight manner and under no circumstance shall any stormwater inflow enter into the sewer system.

Pipe lines may be vulnerable to damage during construction by floatation when the trench becomes flooded. This could result in uplift due to buoyancy which exceeds the weight of the partially completed or completed but not backfilled pipeline. The Contractor shall take all adequate precautions at all times to ensure that no pipeline is displaced or damaged by these effects.

### 3.17 MANHOLES, JUNCTIONS AND STRUCTURES

Manholes shall be constructed as shown on the Standard Drawings and in accordance with the requirements of the relevant Territorial Authority.

A manhole shall be provided at each change of sewer grade and at each change of sewer direction, except that lamp holes, inspection opening\ or the like, may be used with the approval of the Engineer or the Territorial Authority. A manhole shall also be provided at the junction of two or more sewers, where the sewer changes size and, if required by the Engineer, at the head of the sewer line.

In addition, intermediate manholes shall be provided so that the spacing between manholes does not exceed 90m, or some other maximum distance specified by the Engineer or the Territorial Authority.

Manholes may be circular, square or rectangular in plan. Manholes that are circular in plan should have a minimum internal diameter of 1050mm. Non-circular manholes on sewers where depth from the ground surface to invert exceeds 1.5m shall have a minimum dimension of 900mm in either direction. The internal dimension of a circular manhole lid frame should not be less than 500mm. The dimensions stated in this clause allow the use of television cameras for inspection. Shallow manhole or inspection chambers less than 900mm in depth may be lesser dimensions than stated above, but consideration shall be given to the possible need to insert inspection and cleaning equipment. The use of manholes other than 1050 diameter shall have the approval of the Territorial Authority before use.

The base of lightweight precast manholes should extend beyond the walls so that the surrounding soil augments the weight opposing floatation.

All manholes over 1m deep shall be provided with step irons, recessed in the case of small manholes. When the depth exceeds the required depth as per the Territorial Authority standards, galvanised steel ladders are recommended. Step irons and ladder rungs projecting not less than 125mm should be evenly spaced at nominal 300mm vertical intervals. The lowest iron or rung shall be not more than 450mm above the benching and the highest not more than 600mm below the top surface of the manhole cover.

In deep manholes, removable steel grillage type platforms shall be placed at 6m vertical intervals. Steel ladders connecting platforms shall be placed on opposite walls, or staggered alternately right and left on the same wall. The

least dimension in access openings of platforms shall not be less than 500mm, or as defined by the Territorial Authority requirements.

Step irons shall be safety steps and should be formed from mild steel rod of 20mm minimum diameter and all steel work shall be hot-dipped galvanised at the rate of 0.7kg/m<sup>2</sup>. Alternatively, the use of marine quality (Type 316 or similar) stainless steel or high strength synthetic (plastic) coatings should be considered in situations likely to be exceptionally corrosive.

The grade across the invert of a manhole shall be not less than the general grade of the sewer. Where the sewer changes direction additional fall should be provided, of a least 12mm for every 30 degrees change in direction.

Where a manhole structure carries traffic the cast Iron and concrete lids shall be heavy duty. It shall be well supported to minimise transfer of traffic load to the pipeline.

Where drop junctions are used to connect drains to sewers, particular care should be taken with the bedding of the drain immediately above the drop junctions, as settlement of the drain may cause fracture of the sewer. Preferably, the drop connection should be constructed inside the manhole, enlarged if necessary to maintain adequate access clearance, or the use of two flexible joints is recommended. The Territorial body requirements as to internal or external drops shall be checked.

The Drainage and Plumbing regulations 1978 set out certain requirements for drains in or under buildings.

### 3.18 ACCESS SHAFTS/CHAMBERS

Access shafts/chambers are non man-entry access points and the relevant Territorial Authority permits the use of such units manufactured from PVC, polyethylene (PE), polypropylene (PP) for use in non trafficked areas.

Access shafts/chambers shall be bedded and backfilled in granular bedding material, passing 19mm sieve to provide a complete surround of at least 250mm. The backfilling shall be carried out as follows:

- Backfill material shall be well compacted, but the compaction loads shall not exceed the loads recommended by the manufacturer.
- Backfilling shall be brought-up uniformly on all sides, ensuring that differential loads are not exerted on the access shaft.
- Where PE pipe is connected to a PVC base, 17.5mPa concrete bedding up to the spring line shall be provided as shown in the relevant Territorial Authority requirements.

In PE piped networks, access shafts/chambers shall be made only from PE. Provided that units from PVC may be used at the ends of the PE pipe network to provide for lot connections.

At the top of the access shaft/chamber riser, an appropriate watertight access cover cap shall be provided. The cap shall be easily removed for maintenance access, but shall have a durable watertight seamless ring seal when in place. The ring seal shall be retained so as not to fall into the sewer when the access cover cap is removed.



Plastic access cover caps shall be protected by means of a manhole cover and frame. The frame shall be supported on a concrete pad that is structurally separated from the access shaft/chamber riser. A 17.5MPa concrete surround shall be provided to secure the frame of the cover.

The access shaft/chamber riser shall be vertical or within 2% angle to vertical.

In case where two materials to be joined are not the same (e.g. PVC to PE), pipes shall be joined by means of a PE/PVC adaptor having elastometric ring seal joints as specified in the relevant Territorial Authority requirements. The ring stiffness at all points of the adaptor shall not be less than SN16, once the PVC pipe is fully inserted into the adaptor.

For access shafts/chambers manufactured from PVC, the following shall apply:

- The access shaft/chamber riser shall be connected to the base using flexible “O” ring joints (spigot/socket or polypropylene coupler). The design of the “O” ring/gasket joints shall be so as to prevent any displacement of the ring/gasket due to external/internal water pressure or during installation. Seals shall not move (blow out or in) under differential water pressure or during handling.
- The access shaft/chamber shall be a manufactured unit incorporating a benched base, standard pipe joints for connection, a suitable transition from the base to a riser (e.g. conical shape) and a vertical riser. The main channel in the base of the unit shall have a gradient not less than 1%. All the components of the manufactured unit shall be easy to assemble on site to form a watertight unit.
- The inlet and outlet pipes shall be connected to the access shaft/chamber by means of flexible “O” ring joints (spigot/socket or polypropylene coupler)
- Access shafts/chambers with straight through bases (i.e. one inlet and outlet), shall have a shaft/riser with a NB diameter of not less than 300mm for ND 150mm sewers and/or NB diameter 100mm laterals. Chambers with five inlet/outlets, or with a double junction base (i.e. three inlets and outlets), shall have a riser NB diameter of at least 450mm.
- Access shafts/chambers with one inlet, the depth to the invert of the outlet from the manhole lid shall not exceed 3.0m while for access shafts/chambers with three inlets at base level, the depth to the invert of the outlet from the manhole lid shall not exceed 1.25m.

For access chambers with a globular base manufactured from PE, the following shall apply:

- The chamber shall consist of a factory manufactured benched base or a globular base of at least 550mm nominal inside diameter, standard pipe joints for connections, vertical riser and suitable transition from the base to the riser (e.g. conical shape).
- The NB diameter of the riser shall not be less than 225mm.
- The depth to the invert of the outlet from the manhole coverlid shall not exceed 3.0m.

- The components inlet, outlet, benching, base, transition, and riser up to the lid level shall be either manufactured as one single unit, or designed to be joined using seamless ring seals.
- PE pipes shall be joined to the inlet and outlet using butt or electro fusion welding.

### 3.19 BACKFILLING

No backfilling shall be carried out until the section of pipeline to be backfilled has been approved by the Engineer as passing all necessary tests and all junctions and house connections have been located by measurement for as built recording.

Pipes with high thermal expansion should be covered with minimum thickness of 100mm of bedding materials or selected backfill, or otherwise protected from expansion or contraction as approved by the Engineer.

Where concrete bedding is specified, it shall be kept continuously damp or otherwise protected against rapid drying until the trench is backfilled or for 7 days, whichever is the lesser. Except with the approval of the Engineer, a trench containing concrete bedding shall not be backfilled before the following periods have elapsed after pouring.

Cold weather (below 8°C)	6 days
Temperate weather	2 days

The trench shall be backfilled as soon as possible after laying, inspection and testing or with concrete bedding after the required setting period.

Timbering shall be withdrawn as the backfilling proceeds taking care to ensure that any resulting cavities are filled with compacted filling.

The “selected compacted fill” shall be free of organic materials, lumps larger than 75mm and stones larger than 50mm. It shall be carefully introduced and placed and compacted by hand and over the pipe.

Each layer of backfill shall be spread and compacted before the next layer is placed. Where hand compaction is required the layers should not be thicker than 150mm un-compacted thickness. The thickness of subsequent layers depends on the method of compaction; note layers should not generally be thicker than 300mm before compaction.

Backfill material should not be substantially wetter or drier than the surrounding soil because some backfill spoils may expand or shrink as they attain the same moisture contents as the surrounding soil. For the same reason, backfill material markedly different in character from the surrounding soil should not be used except with the approval of the Engineer.

### Application – testing

### 3.20 GENERAL

After pipe laying and manhole construction, but before backfilling, the Contractor shall clean out all lines, manholes, inspection chambers and associated structures and ensure they will pass any tests required by the Territorial Authority or Drainage Authority.

Sewer drains, pumping and other pressure mains, intended for the conveyance of sewage, or effluent shall be tested to establish freedom from defects of materials and workmanship. Sewers and drains intended for stormwater may be tested.

Testing before backfilling and placing concrete bedding or surround is advisable and facilitates observation and repair of defects. Pipes to be air tested may need to be protected from direct exposure to the sun to avoid the effect of temperature on the test.

Final acceptance should be based on testing carried out after all backfilling has been completed and for which many prior open trench testing should not be regarded as a substitute.

An exception to this procedure may apply in the case of house drains whose acceptance is usually based on testing before backfilling. However, this should not preclude examination for infiltration after backfilling.

### 3.21 METHODS OF TEST

None of the air tests is suitable for testing of pressure mains. Any one of the test methods described below may be used for sewers and drains. Refer to Appendix B for discussion of the suitability and reliability of the various methods of test. Serious defects in pipeline will generally become immediately apparent by failure to achieve the specified test conditions.

### 3.22 WATER TEST

The pipeline under test shall be subjected where practicable to a minimum internal pressure of 1.5m head of water above the top of the pipe at the high end, but not more than 6m at the low end. Pipelines laid to steep gradients should be tested in stages to avoid exceeding the maximum pressure indicated above. Where a pipeline will normally operate under pressure (for example, a pumping main or inverted siphon), the test pressure shall be twice the working pressure or 1.5m, whichever is the greater. Where a buried pipeline is below groundwater level, the minimum test head of 1.5m shall be measured above the level of the groundwater.

The test line should be sealed by fixing suitably struttled plugs at both ends and into side connections, if necessary, and filled with water, care being taken to expel all air. The line should be maintained filled with water for an absorption period of 24 hours.

It should then be topped up to the test head and the leakage measure over a period of at least 30 minutes. Only pipes of water absorptive material may need to be backfilled 24 hours prior to testing.

The acceptance limit shall be a water loss not exceeding 2ml per hour per mm of internal diameter per m of pipeline length.

Where high pressure testing of UPVC and PE pipe used for pumping mains or siphons is necessary, such pipelines shall be water tested by methods set out in Section 9 of NZS7643

**3.23 LOW PRESSURE AIR TEST**

The pipeline under test should be effectively plugged as for the water test, particular care being taken to fix plugs against movement, and air introduced by a suitable means (such as hand pumps) until a pressure of 300mm of water is indicated by a suitable manometer (such as a U-tube) connected to the system.

After air has attained a uniform temperature, as indicated by the pressure becoming steady, the source of air supply shall be physically disconnected and the pressure drop measured after a test period of 5 minutes.

The wetting of ceramic and concrete pipelines before test, where practicable, is strongly recommended.

The acceptance limit shall be a pressure drop not exceeding 50mm in 5 minutes.

Where the pipe being tested is UPVC, there shall not be any pressure drop permitted.

**3.24 HIGH PRESSURE AIR TEST**

The pipeline under test shall be effectively plugged as for the other tests, care being taken to secure the plugs against movement, and pressurised by a compressor or other appropriate means to a pressure of 25 kPa.

A period of at least two minutes shall be allowed to ensure temperature stabilisation. The source of air supply shall be physically disconnected and the time for the test pressure to drop from 25 kPa to 17 kPa noted.

The wetting of ceramic and concrete pipelines before test, where practicable, is strongly recommended.

The acceptance limit shall be as follows:

Pipe diameter mm	Time in minutes for permissible pressure drop
100	3
150	4
200	6
230	6.5
250	7.5
300	9

**3.25 TESTING BEFORE BACKFILLING**

Quantative results from air and water tests performed in an open trench (or above ground) can be poor indicators of the presence of defects in a pipeline because of the influence of temporary effects not anticipated under service conditions.

For all testing before backfilling, the trench should be dewatered and groundwater maintained below pipe invert for the duration of the test.

**3.26 TESTING AFTER BACKFILLING**

Tests performed after backfilling generally provide a reliable indication to the soundness of a pipeline because of constant temperature and uniform

wetting. Under these conditions the acceptance limits given above may also be used for rejection.

If the groundwater level is above the buried pipeline, a test for infiltration may be carried out by observing the actual leakage into the line. The Engineer may establish the acceptance rate of infiltration but the pressure of visible infiltration should be a basis for rejection. If the flow of groundwater is more than a trickle along the invert, bearing in mind the length of line under observation, its source shall be investigated and any defect discovered made good.

Where a buried pipeline is below groundwater level, the minimum test head of 1.5m shall be measured above the level of the groundwater.

If permitted by the Engineer, air tests may be used in place of water tests under conditions of high groundwater, in which case a gain in pressure may indicate that a pipeline is unsatisfactory.

## APPENDIX A

### COMPACTION TEST FOR GRANULAR BEDDING MATERIAL

#### A1 APPARATUS REQUIRED:

- (a) Open-ended cylinder 150mm + / - 5mm internal diameter by 250mm.
- (b) Metal rammer with striking face 40mm and weighing 1kg = 0.1kg.
- (c) Measuring rule.

#### A2 METHOD

Obtain a representative sample more than sufficient to fill the cylinder (about 12kg) by successive halving of about 50kg of the material to be tested. It is important that the moisture content of the sample should not differ materially from its likely condition at the time of its use in the trench.

Place the cylinder on a firm, flat surface and gently pour in the sample material, loosely and without tamping. Strike off the top surface level with the top of the cylinder and remove all surplus material. Lift the cylinder clear of its contents and place on a fresh area of flat surface.

Replace about one-quarter of the material into the cylinder and tamp vigorously with 10 blows of the rammer. Repeat with the second quarter, tamping as before, and so on for the third and fourth quarters, tamping the final surface as level as possible.

Measure down from the top of the cylinder to the surface of the compacted material and divide by the overall height of the cylinder to obtain the compaction Fraction.

The compaction phase of the test shall then be repeated as above, except that each layer shall be tamped vigorously with 20 blows of the rammer.

#### A3 COMPACTION FRACTION (20 blows per layer):

- |             |  |
|-------------|--|
| 0.1 or less | Material suitable.                                       |
| 0.1 to 0.2  | Material suitable but requires extra care in compaction. |
| Over 0.2    | Material unsuitable.                                     |

#### A4 EASE COMPACTION

The compaction Fraction after 10 blows per layer should be not less than 80 percent of that after 20 blows per layer.



## APPENDIX B

### BACKGROUND NOTES ON TESTING

#### B1 GENERAL

B1.1 All the test methods described can be susceptible to temporary effects, which are unrelated to the ability of a pipeline to act as a sewer or drain. It is therefore important to regard the tests as an indication of freedom from defects, not as measures of likely future performance. The test methods are described in terms of their advantages and disadvantages.

#### B2 WATER TEST

B2.1 The chief disadvantages are the obvious requirement of comparatively large quantities of water and the development of excessive hydraulic pressure on steep grades. Absorption effects can lead to apparent leakage. These effects will depend on the initial dryness of the pipeline, air entrapped in the pipeline and the preliminary soaking time permitted before water loss measurements are made.

B2.2 Any defects, whether in the pipeline or in the equipment used for the test are more readily detected than in the case of the air tests.

#### B3 LOW PRESSURE AIR TEST

B3.1 This test is highly susceptible to temperature fluctuations during the test period. A 1 degree C change during the 5 minute test period will cause a pressure change of 30mm water gauge or 60 percent of the permitted change.

B3.2 Ceramic and concrete pipes can conduct significant quantities of air through dry pipe walls, although giving negligible passage to water. The air loss from this cause can be highly variable and depends on the moisture condition of the pipe wall. Initial wetting of the pipe wall is recommended where practicable.

B3.3 The equipment required for this test is very simple, although leaks in plugs and seals can frequently occur and be difficult to detect.

B3.4 Backfilling ensures both constant temperature and dampness, hence removing the major causes of uncertainty in air test results.

#### B4 HIGH PRESSURE AIR TEST

This differs from the low pressure air test in three important respects:

- (a) As a result of the greater pressure drop during the test, a 1 degree C change during test will affect the time by only 6 percent. The method is therefore comparatively insensitive to temperature changes.
- (b) Because air is compressible, strict safety precautions should be taken in fitting plugs and seals, to avoid violent blow out.
- (c) External sources of compressed air are required.

## SECTION 900 WATERMAINS

---

### TABLE OF CONTENTS

<b>1</b>	<b>GENERAL.....</b>	<b>2</b>
	<b>Documents.....</b>	<b>2</b>
1.1	DOCUMENTS REFERRED TO .....	2
<b>2</b>	<b>PRODUCT .....</b>	<b>3</b>
	<b>Materials.....</b>	<b>3</b>
2.1	MATERIALS .....	3
2.2	PVC .....	3
2.3	POLYETHYLENE.....	3
2.4	CONCRETE LINED MILD STEEL.....	3
2.5	ASBESTOS CEMENT .....	3
2.6	SLUICE VALVES .....	3
2.7	PEET VALVE .....	3
2.8	VALVE INDICATOR POSTS .....	3
2.9	VALVE BOXES.....	4
2.10	HYDRANTS .....	4
<b>3</b>	<b>EXECUTION.....</b>	<b>4</b>
	<b>Conditions.....</b>	<b>4</b>
3.1	PIPE PRESSURE CLASS.....	4
3.2	DEPTH OF WATERMAIN.....	4
3.3	PERMITS AND INSPECTIONS .....	5
3.4	DISINFECTION OF MAINS .....	5
3.5	CONNECTIONS TO EXISTING MAINS.....	5
3.6	ASBUILT PLANS .....	5
3.7	RESTORATION .....	5
	<b>Application.....</b>	<b>5</b>
3.8	TRENCHING .....	5
3.9	PIPE BEDDING .....	6
3.10	PIPE LAYING.....	6
3.11	BACKFILLING .....	6
3.12	SERVICE CONNECTIONS.....	6
3.13	THRUST BLOCKS.....	7
	<b>Application – testing.....</b>	<b>7</b>
3.14	TESTING .....	7



## SECTION 900 WATERMAINS

---

### 1 GENERAL

This specification covers all works associated with the construction of all watermains, service connections, hydrants, valves, fittings, thrust blocks and any other works necessary for the completion of the works in accordance with the Contract Drawings.

#### Documents

##### 1.1 DOCUMENTS REFERRED TO

Documents referred to in this section are:

*SNZ PAS4509* New Zealand Fire Services Fire Fighting Water Suppliers Code of Practice

*NZS4442* Welded steel pipes and fittings for water, sewage and medium pressure gas.

*AS/NZS1477* PVC pipes and fittings for pressure applications.

*AS/NZS2280* Ductile iron pressure pipes and fittings.

*AS/NZS4129* Fittings for polyethylene (PE) pipes for pressure applications.

*AS/NZS4130* Polyethylene (PE) pipes for pressure applications.

*AS/NZS4131* Polyethylene (PE) compounds for pressure pipes and fittings.

*AS/NZS2032* Installation of PVC pipe systems.

*AS/NZS2033* Installation of polyethylene pipe systems

*AS/NZS3725* Buried flexible pipelines – Structural Design.

*NZS/BS750* Specification for underground fire hydrants and surface box frames and covers.

*NZS4501* Code of practice for the location marking of fire hydrants.

*NZS/BS5163* Specification for predominantly key operated cast iron gate valves for waterworks purposes.

*NZS7643* Code of Practice for the installation of unplasticised PVC pipe systems.

*AS/NZS4331.1* Steel flanges.

*AS/NZS4331.2* Cast-iron flanges.

*AS/NZS4331.3* Copper alloy and composite flanges.

New Zealand Building Code Approved Document G12.

Note: Documents listed above and cited in the clauses that follow are part of this specification. Where there are differences between the specifications and the Territorial Authority requirements, the Territorial Authority requirements shall take precedence.

## **2 PRODUCT**

### **Materials**

#### **2.1 MATERIALS**

All pipes and materials used shall conform with the requirements of the above standards to which ever is applicable:

#### **2.2 PVC**

PVC (uPVC & mPVC) pipes shall comply with AS/NZS1477. PVC and uPVC pipes of not less than SN12 and mPVC SN16 are acceptable in all normal circumstances.

#### **2.3 POLYETHYLENE**

Polyethylene (PE) pipes shall be to AS4130, AS/NZS4131 (PE 80B). PE pipes for in ground installation shall be blue in colour unless permitted otherwise by the Engineer. Rider mains of 50mm NB (63mm OD) shall be constructed from PE80B only.

#### **2.4 CONCRETE LINED MILD STEEL**

Concrete Lined Mild Steel Pipes (CLMS) shall comply with NZS4442 and shall have an approved concrete lining of not less than 7mm and adequate protective coating on the outside of the pipe.

#### **2.5 ASBESTOS CEMENT**

Asbestos cement and Galvanised steel pipes shall not be used.

#### **2.6 SLUICE VALVES**

Sluice valves on all watermains shall be Class 1 to NZS/BS5163 and shall be resilient seat type anticlockwise closing with non-rising spindle. Valves shall be flanged when laid next to another cast iron fitting or when required by the Engineer. 'On line' valves may be spigotted to take flexible joints, (gibault or rubber ring).

#### **2.7 PEET VALVE**

Gate valves (Peet Valve) shall be to resilient seated, NZS/BS5163 or NZS/AS 2638. They shall be clockwise closing.

#### **2.8 VALVE INDICATOR POSTS**

The position of all valves on fire mains and rider mains shall be indicated by means of appropriate coloured concrete or PVC indicator posts, except that the posts shall bear the inscribed letters 'SV' or 'PV' to indicate either 'sluice' valves or 'peet' (gate) valves. Valve indicator posts shall be painted blue.

## 2.9 VALVE BOXES

Where circular or square boxes are used, the rim should be clearly notched at two opposite points, and these notches aligned with the direction of the water main. Where oblong boxes are used, they should be aligned with the water main. Where located in grass berm valve boxes shall have a minimum cast insitu or precast concrete surround in accordance with the Territorial Authority requirements.

## 2.10 HYDRANTS

All principal watermains shall be provided with hydrants for fire fighting. Hydrants shall be manufactured from ductile iron conforming to NZS/AS1831. The hydrant shall tall or medium pattern or as specified by Territorial Authority Standards and shall be clockwise closing, resilient seated, screw down, all conforming to NZS/BS750. The hydrant shall no be self draining. Hydrant tees shall be flanged and nylon coated or fusion bonded epoxy coated. Hydrant risers shall be used, or the water main laid deeper, where necessary, in order to ensure that the top of the spindle is between 250mm and 300mm below finished surface level.

The manufacture and installation of hydrant boxes shall be to NZS/BS750. Hydrant boxes located in carriageways or vehicle crossings shall be the heavy duty type. Hydrants located in grass berms shall have a minimum 150x150 concrete edging around lid. All hydrants are to have location markings to NZS4501.

# 3 EXECUTION

## Conditions

### 3.1 PIPE PRESSURE CLASS

Principal Watermains are to be 100mm NB or greater for residential and 150mm for commercial. All principal watermains shall be no less than 12PN (1200KPa).

- PE pipes – PN12 or PN16
- mPVC – PN12 Or PN16
- CLMS – Generally 4.5 MPa
- Ductile Iron Pipes – PN20, PN35 or K9

### 3.2 DEPTH OF WATERMAIN

Depth of mains shall be as follows unless in circumstances which requires special protection and is directed by the Engineer:

- Minimum depths from finished surface level to top of all pipes:
- Under grass berms and footpaths 600mm
- Under carriageway subgrade 900mm

Where minimum cover cannot be achieved, additional protection is required, which requires specific design and approval.

### 3.3 PERMITS AND INSPECTIONS

The Contractor shall take out all necessary permits to conform to the By-Laws of the Territorial Authority concerned. All inspections by the Territorial Authority Officers shall be arranged by the Contractor and any costs incurred through inspections, permits, connections, restoration of Public Property, shall all be paid by the Contractor.

### 3.4 DISINFECTION OF MAINS

Before final connection to Territorial Authority water supply, the new water mains shall be sterilised according to Territorial authority standards. Contractors shall notify the Territorial Authority prior to carrying out this work. An approved backflow preventer must be installed when introducing the sterilising solution.

The disinfection solution shall be collected and disposed of in an appropriate manner. Reference shall be made to the relevant Regional Council to ascertain the conditions for discharging chlorinated water.

### 3.5 CONNECTIONS TO EXISTING MAINS

All connections of new mains to existing mains will be made by the Territorial Authority Waterworks staff or by an authorised licensed contractor, or under the supervision of the Territorial Authority. The Contractor shall commence laying the new main approximately 2m away from the end of the existing main and in such a position that the closing piece can be laid without angular deflection, in a horizontal or vertical direction.

### 3.6 ASBUILT PLANS

The Contractor shall upon completion of the works deliver to the Engineer "As Built" plans showing the position of all pipes, hydrants, valves, bends, connections and specials installed. The Engineer will supply further copies of the contract plans for this purpose when required.

The work will not be considered as complete until this has been done to the Engineer's satisfaction and the certificate of Substantial Completion will not be issued until this information has been received.

### 3.7 RESTORATION

Upon the completion and approval of the Engineer, all lawns, paths, fences, streets, walls and other features which have been affected and disturbed by the operations of the Contractor, shall be restored to a standard equal to or better than existed prior to works. All surplus materials shall be disposed of as directed by the Engineer.

## Application

### 3.8 TRENCHING

Trenches for all pipes shall be of sufficient depth to allow for the cover as stated in Clause 3.2. Trenches shall be excavated in a straight line or in even curves between bend fittings as per the recommendations of the manufacturer. Where thrusting of water mains is not possible under existing seal areas, the contractor shall saw cut along both edges of the proposed trench in a straight line parallel to the pipe line. The trench bottom shall be trimmed to an even level and be free of debris, rocks and other obstacles that may cause damage to the line. When excavation is commenced, the top course,

which may be turf, soil, or road metal, shall be stripped first and shall be kept entirely separate from the remaining excavation. On backfilling, the topsoil shall be replaced in its original position, and the surface restored as near as possible to its original condition.

### 3.9 PIPE BEDDING

Water main pipes shall be bedded on suitable fine granular material. All water mains under the carriageway shall have sand or fine granular bedding and surround. The requirement for bedding and surrounding of uPVC pipe is set out in NZS7643. There shall be no sharp stones or any large lumps of clay material in the bedding or surround.

### 3.10 PIPE LAYING

Pipes shall be laid on straight grades, or in smooth curves, provided that the manufacturer's recommended maximum deflection angle between adjacent pipes is not exceeded. Where a greater degree of curvature must be obtained, special bends of an approved type must be used. Thrusts at bends must be taken by adequate cast-in-place concrete thrust blocks where necessary and any capped ends of mains must also be supported adequately. Such blocks must not obstruct subsequent access to service connections or to bolts or caulked joints for tightening or recaulking. The method of pipe-laying must be in accordance with the manufacturer's recommendations for the class and type of pipe used, and, in particular, the barrel of each pipe shall be evenly supported throughout its length by the bedding on the trench floor.

During the course of pipe-laying, every endeavour shall be made to exclude foreign matter from mains, rider mains or service pipes. To this end, all temporary openings such as pipe ends, hydrants and hydrant tees, valves, and other fittings, shall be effectively covered throughout the work, and all pipes shall be inspected and cleaned as pipe laying proceeds.

### 3.11 BACKFILLING

Backfilling shall not be commenced before flushing, and testing to approval has been completed except that sufficient material shall be placed over the barrel of each pipe where necessary to hold it in position in the trench under pressure during test. All pipe joints, service and other connections, valves, hydrants, tees and other pipe fittings shall be exposed until testing is complete.

Backfilling over the pipes shall be completed up to finished surface level in two operations. A layer of selected backfill material shall be uniformly and properly consolidated to a depth of approximately 150mm over the layer of 75mm sand or fine granular material surrounding the pipes before further backfilling proceeds.

If the material originally excavated from the trench is declared to be unsuitable for backfilling, it shall be removed from the site and an approved material used in its place. Subsequent settlements of backfilled material shall be made good until such time as the maintenance period has expired.

### 3.12 SERVICE CONNECTIONS

The alkathene or other approved service pipe shall be connected to the water mains by means of an approved type of Talbot ferrule fitted to the top of the pipe, and not to the side. All peet valves shall have a suitable cast iron toby

box fitted over them. Service connections shall only be installed where required by the Territorial Authority.

The service pipe if required shall be installed as per the Territorial Authority requirements.

The Talbot ferrule shall be screwed into an approved type of tapping band or saddle, or into an elongated joint on the reticulation pipe, as per the Territorial Authority requirements.

Note that some Territorial Authorities do not require any service connection, and some Territorial Authorities only require the Talbot ferrule and tapping band to be placed, and the connection made at the time of building. In all other cases, the house connection between the Talbot ferrule and the toby box is NOT to be laid until after the Underground services are completed.

### 3.13 THRUST BLOCKS

Thrust blocks will be provided at all bends, tee, hydrants, valves, ridermain connections, terminals and any other position where an unbalance in hydraulic thrust may occur. The thrust blocks will be constructed in such a manner that they do not interfere with access to adjacent joints, fittings, or future service installations. Unless otherwise directed by the Engineer, the construction of the thrust blocks shall be of a minimum of 17.5MPa concrete at 28days and will be a minimum of 0.25m<sup>3</sup> in size. Thrust blocks will be fully cured prior to any loads being subjected to them. The workmanship of these thrust blocks will be done to a tidy manner and formwork shall be used where necessary.

### Application – testing

### 3.14 TESTING

All new mains shall be tested under pressure to the satisfaction of the Engineer and the Territorial Authority. Prior to testing, all lines shall be thoroughly flushed with water. All the new pipe work shall be filled with water at mains pressure and all air eliminated from the system. Any leaks found after a visual inspection at this stage shall be made good.

When pipe is ready for pressure test, the Engineer shall be given as much notice as is practicable, but a minimum of 48 hours. A pressure gauge will be provided by the Contractor and installed at some convenient and approved point on the system. By means of a pump delivering water into any convenient and approved connection, the pressure in the whole system shall be increased in accordance with the following table of test pressures for Class of pipe in use:

- Class B      122m head or 1210 kPa
- Class C      183m head or 1820 kPa
- Class D      244m head or 2420 kPa

(In general, pipes will be Class C).

The reticulation shall withstand the test pressure measured at the lowest point of the section under test. The test procedure shall be:



(a) For all pipe materials except MDPE

The test pressure shall be maintained for 15 minutes without any drop in pressure.

(b) For MDPE pipe

The test procedure shall be identical to that for all other pipe types, except that if a 1400kPa pressure cannot be maintained for 15 minutes, the pipe will pass the pressure test if the following criteria are met:

The pressure shall be rapidly lowered to 300kPa on the test gauge by opening of the release valve at the extremity of the system under test. When 300kPa is reached the valve shall be shut off and, in order for pipeline to pass the test, the pressure on the test gauge shall have to increase by 150kPa (i.e. reach 450kPa) within 10 minutes.



## SECTION 1000 TRENCHING AND DUCT INSTALLATION FOR NETWORK UTILITIES

---

### TABLE OF CONTENTS

<b>1</b>	<b>GENERAL.....</b>	<b>2</b>
	<b>Documents.....</b>	<b>2</b>
1.1	DOCUMENTS REFERRED TO .....	2
	<b>Requirements .....</b>	<b>2</b>
1.2	APPLICABLE NUO's .....	2
<b>2</b>	<b>PRODUCT .....</b>	<b>2</b>
	<b>Materials .....</b>	<b>2</b>
2.1	MATERIALS .....	2
<b>3</b>	<b>EXECUTION.....</b>	<b>3</b>
	<b>Conditions.....</b>	<b>3</b>
3.1	IDENTIFYING EXISTING UTILITIES .....	3
3.2	CONTRACTORS ENQUIRIES AND LIAISON .....	3
3.3	DIRECTIONS BY NUO's .....	3
3.4	APPROVAL BY NUO .....	3
3.5	MEASUREMENT AND PAYMENT .....	3
	<b>Application.....</b>	<b>4</b>
3.6	LOCATION .....	4
3.7	EXCAVATION .....	4
3.8	BEDDING, SURROUND AND BACKFILLING .....	4
3.9	SURPLUS SPOIL .....	4





## **SECTION 1000 TRENCHING AND DUCT INSTALLATION FOR NETWORK UTILITIES**

---

### **1 GENERAL**

This specification covers the liaison with the various Network Utility Operators (NUO's) who are specified as laying their services as part of the project along with the excavation and backfilling of trenches for the NUO's services.

#### **Documents**

##### **1.1 DOCUMENTS REFERRED TO**

Documents referred to in this section are:

NZS 4402 Methods of Testing Soil for Soil Engineering Purposes  
Code of Practice for Working in the Road (Auckland Region) published by the  
Auckland Utilities Operators Group (AUOG)

Note: Documents listed above and cited in the clauses that follow are part of this specification. Where there are differences between the specifications and the Territorial Authority requirements, the Territorial Authority requirements shall take precedence.

#### **Requirements**

##### **1.2 APPLICABLE NUO's**

The NUO's who are providing services as part of the project are as listed below:

- Telecom
- Power

### **2 PRODUCT**

#### **Materials**

##### **2.1 MATERIALS**

All pipes, cable, access chambers etc required will be provided by the NUO outside the contractor's price.

Materials to be provided by the contractor shall be any special bedding and surround materials (sand etc) required by the NUO and any trench backfill and reinstatements set within the contract.

### **3 EXECUTION**

#### **Conditions**

##### **3.1 IDENTIFYING EXISTING UTILITIES**

The contractor shall identify and locate all existing services prior to any works commencing. Maps and plans provided shall be used as a guide only and the use of electronic cable or pipe locators is advised for added confirmation of the location of existing services. The contractor shall arrange all permits and any site supervision (stand over) by the NUO and all costs associated with this shall be borne by the contractor.

##### **3.2 CONTRACTORS ENQUIRIES AND LIAISON**

The contractor shall enquire of the listed NUO's prior to tender to ascertain their requirements with respect to trench depths, locations, clearances, bedding etc and their timing requirements, or as shown in the tender drawings.

The contractor shall liaise with the NUO's throughout the contract so that the works done by the NUO can be co-ordinated and managed. The contractor shall be responsible for ensuring that the total project programme is met by all parties.

The contractor shall attend on the NUO undertaking work as required. The contractor shall ensure that all NUO personnel entering the work site meet as a minimum the safety, quality and contract requirements set by the contractor for the project.

##### **3.3 DIRECTIONS BY NUO's**

All directions or requests made by NUO's that could result in a variation to the contract shall be submitted to the engineer in writing. Requests made by service authorities and not approved by the engineer will not be accepted as variations.

##### **3.4 APPROVAL BY NUO**

On completion of the work and before Practical Completion for the contract will be issued, the contractor shall obtain statements in writing from all relevant NUO's that the work done by both the contractor and the NUO meets the standards of the NUO and is approved as suitable for use by the Territorial Authority and future users.

##### **3.5 MEASUREMENT AND PAYMENT**

Measurement and payment shall be made for completed trenching and duct placing (where applicable) will be made on a lineal basis for each metre of trench.

Payment shall include all costs for liaison, excavation, bedding and backfilling in accordance with the specification.

## **Application**

### **3.6 LOCATION**

Positioning of the ducts shall be as indicated on the drawings or as may be directed by the engineer in liaison with the NUO's.

Ducts shall be laid in advance of road pavement and footpath construction on a firm base free from protruding rocks, stones and any sharp edged articles between 600mm and 1metre maximum below finished road level.

Joints in the ducts must be made in such a way that there can be no relative movement between the pipes due to traffic movement or subsidence.

The ends of the ducts are to extend 300mm behind the back of the kerb or finished seal edge respectively. The final positions shall clearly be marked on the kerb for ease of location.

The ducts shall be left complete with draw wires and with ends temporarily sealed.

### **3.7 EXCAVATION**

Excavation shall be undertaken in work lengths meeting the requirements of the NUO and able to be serviced quickly by the NUO. Trench safety and stability shall be the responsibility of the contractor.

### **3.8 BEDDING, SURROUND AND BACKFILLING**

Bedding and surround material and any tape trench marking for the NUO services shall be as specified by the NUO. The contractor shall be responsible for ensuring the NUO requirements are clearly understood before commencing work. No backfilling shall be undertaken without the approval of the NUO.

Backfilling and compaction of trenches to a state of stability consistent with the future of the surface shall be carried out to the satisfaction of the relevant Territorial Authority.

### **3.9 SURPLUS SPOIL**

Surplus spoil from trenching operations shall be either incorporated into the bulk fill where directed and approved by engineer or removed from the site. Clean up continually if dropped on footpaths or roads.